SCIENTIFIC AMERICAN

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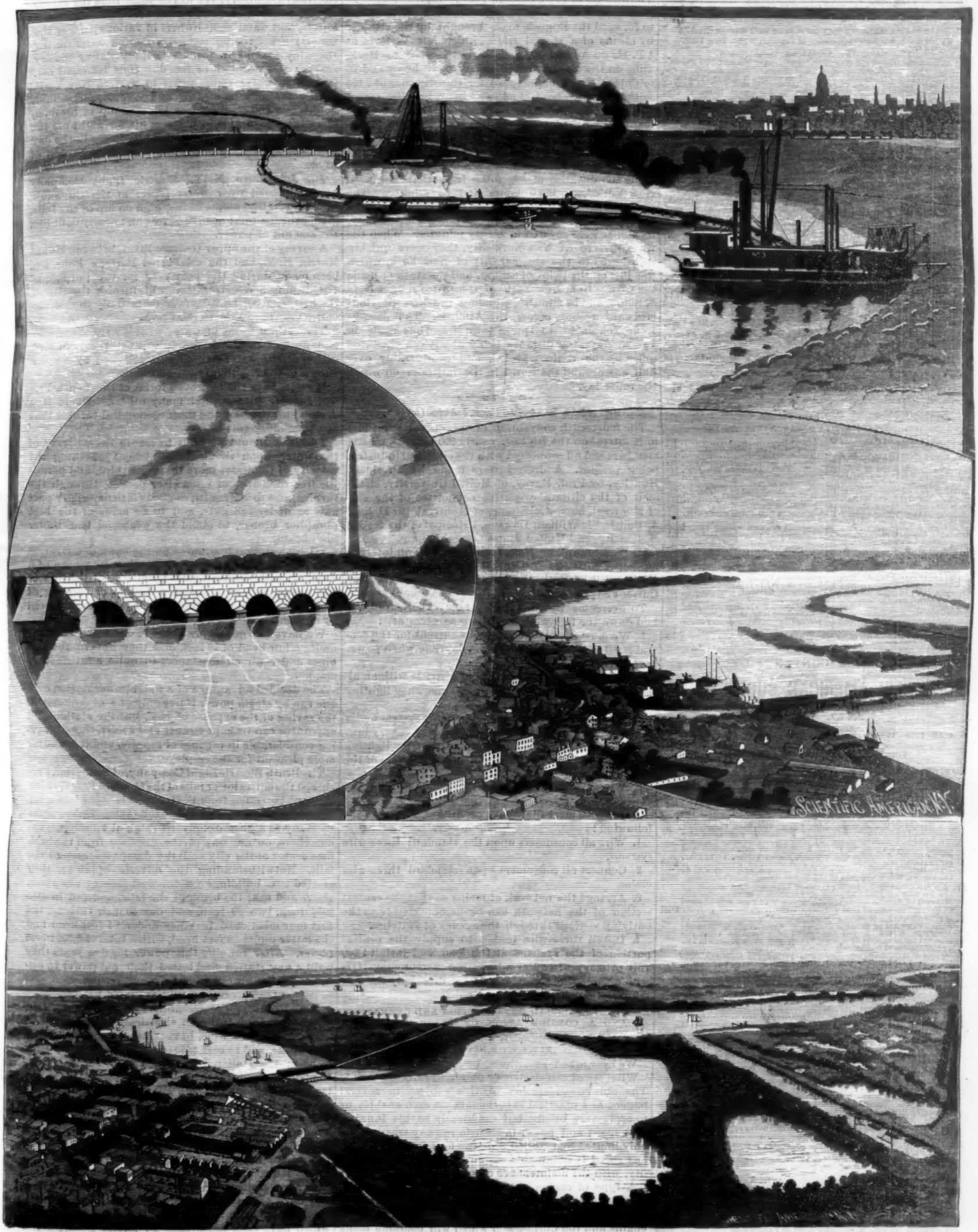
A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. LXV.—No. 12. ESTABLISHED 1845. NEW YORK, SEPTEMBER 19, 1891. $3.00 A YEAR. WEEKLY.



1. McNee dredge removing material to a distance. 2. Reservoir outlet. 3. General appearance of island before the work was commenced. 4. Bird's eye view from top of Washington monument, showing present appearance of island and other reclaimed lands.

IMPROVEMENT OF THE POTOMAC FLATS, WASHINGTON D. C.—[See page 180.]

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

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One copy, one year, for the U. S., Canada or Mexico.....$3 00
One copy, six months, for the U. S., Canada or Mexico..... 1 50
One copy, one year, to any foreign country belonging to Postal Union. 4 00

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MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

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NEW YORK, SATURDAY, SEPTEMBER 19, 1891.

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(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 820.

For the Week Ending September 19, 1891.

Price 10 cents. For sale by all newsdealers.

QUICK TRAVELING HALF AROUND THE WORLD.

The triumphs of modern engineering skill in facilitating travel by land and sea seem to follow each other in such quick succession that only a mild sort of surprise is generally manifested at the most remarkable achievements, and results which would have been deemed impossible half a generation ago are accepted as but natural sequences in our progress. The steamer Empress of Japan left Yokohama, August 19, and made the voyage thence to Victoria, British Columbia, in 9 days 19 hours and 24 minutes, which was by many hours the best previous record across the Pacific. The officials of the Canadian Pacific Railroad were so pleased with this achievement that they determined to forward the English mails brought by the steamer by means of a special train, which left Victoria at 1 P. M. on August 29, and made the time to Rockville, on the St. Lawrence River, in 77 hours and 20 minutes. The average speed for this distance of 2,803 miles was only about 36 miles an hour, but the record is a good one when it is remembered that there are many heavy grades and the regular time taken for express trains is nearly six days. When the mails were transferred across the St. Lawrence, they were taken by a special train on the New York Central road, which made the distance of 353 miles from that point to New York City in 6 hours and 58 minutes. The average speed of this run was a little over fifty miles an hour, and it is said that in one portion of it ninety-five miles were covered in ninety minutes. When the mails arrived at New York City, they were quickly transferred to the steamer City of New York, which was just on the point of sailing, and the steamer made the voyage from New York to Queenstown in 5 days 22 hours and 50 minutes, equaling the best previous eastward record across the Atlantic. The passage from Yokohama to Queenstown was thus made in twenty days, the distance being about ten thousand miles by the route traveled, and considerably over half way around the world in the latitudes on which the route lay.

NATIONAL ELECTRIC LIGHT ASSOCIATION.

The fourteenth convention of this organization met in Montreal on the 7th inst., nearly 300 persons, mostly members and all connected with the electrical industry, being present. Addresses were made by President Huntley, by Prof. Bovey, of McGill University, chairman of the citizens' executive committee of the city of Montreal, Mayor McShane, of Montreal, Sir Donald A. Smith, Sir William Dawson, Principal of the McGill University, and United States Consul Knapp.

H. W. Leonard, of New York City, read an interesting paper entitled: A Central Station Combining the Advantages of Both the Continuous and Alternating Current Systems.

To overcome the difficulties now experienced, he laid down the following conditions as necessary:

1. We must supply a continuous current for the central portion of a town during the daytime when power is required.

2. We must supply the outlying districts with an alternating current during the night time when lighting is required.

3. We must not operate the alternating system under conditions of light load when its efficiency is very low.

4. We must be able to supply current for lighting continuously throughout the twenty-four hours of the day.

5. We must have but one set of conductors in any consumer's place.

In order to meet the above conditions I propose the following:

1. Wire all consumers upon the standard three-wire systems.

2. Connect all consumers upon standard three-wire mains.

3. Arrange the network of mains so that the central section of the network can be disconnected from the outlying sections through the agency of switches.

4. Install three-wire feeders to supply the central portion of the systems at full load, and install 1,000 volt primary wires and alternating current converters with a three-wire secondary circuit to supply the outlying section at full load.

ELECTRIC RAILROAD CONSTRUCTION AND OPERATION, AND A CONSIDERATION OF THEIR CONNECTION WITH CENTRAL STATION INTERESTS.

BY C. S. FIELD, NEW YORK.

We hear asked sometimes, by laymen, the question: "What speed can electricity obtain in railway work?" The able consideration of this subject in several papers, and practical experiments as well, enables us to reply very briefly but confidently to this inquiry, that speed and power in electric railway traction are only limited by roadbed construction; in other words, any speed is obtainable within the range of possibility, with the maintenance of proper track.

A type of engine which we believe is going to be largely used on this class of work, as well as lighting work, is one that will come in between the high speed engine and the Corliss, and which will combine many of the advantages of both. Such an engine has been sought for by many engineers, and has been attempted by a number of builders. To-day, however, we cannot find it on the commercial market. This engine, in units of 500 horse power, would run at a rotative speed of about 140 or 150 revolutions and with a piston speed of about 650 to 700.

A very striking paper was:

CENTRAL STATIONS OPERATED BY WATER POWER.

BY G. A. BEDMAN, SUPERINTENDENT BRUSH ELECTRIC LIGHT COMPANY, ROCHESTER, N. Y.

Streams that have had no pecuniary value heretofore are now being utilized for the purpose of running electrical machinery, yet at the same time the supply of water is diminishing, caused by the destruction of forests, and water right owners in various parts of the country are devising means of storing water during the rainy seasons to furnish a supply during the dry season; also storing it in the day time for night use. One large water right owner in western New York, during the months of July and August, places flash boards two and one-half feet high on top of his dam, at an expense of $100, and stores up for night use the water which is not necessary for him to use in the day time, thereby saving in the two months a coal bill of $2,100.

The Johnstown, N. Y., Electric Light Company have improved their water power at the Cuyadota Falls by erecting a dam 34 feet high on top of the falls, giving them a total head of 75 feet and nearly doubling the amount of power.

A survey of the upper Genesee River, between Mount Morris, N. Y., and the celebrated Portage Falls, has been made during the past year for the purpose of establishing a reservoir that will furnish the city of Rochester 30,000 horse power more daily during the entire year than they have at present.

The earliest forms of water wheels were the paddle and flutter wheels that only utilized the impulsive action of the water; these were followed by simpler wheels of the reaction type and others.

We now have the improved forms of the Leffel, Victor, Lesner, Success, and many others. There is a demand for the best and most economical turbine that can be manufactured.

Turbines should be built to secure the delivery of the water upon the turbine without checking the velocity of the water more than one-third, and permit the free discharge of same after passing through the turbine, and to work with as good efficiency under part gate as under full gate, and to be made of the best phosphor bronze, to stand the wear and tear under high heads.

Where a station is situated on the bank of a river, it is best to take the water from the river by means of a raceway, with the head-gates parallel with the flow of the water, and at times of a freshet or running of anchor ice, it will more than pay any expense incurred by so doing.

We have two governors in use in our office building under a low head of 16 feet, and they govern the turbines under all circumstances in quite a satisfactory manner.

The decided advantage of a water power station over one run by steam power is not only one of economy in the saving of the expense of coal, but the station and apparatus can be kept cleaner and cooler, thereby saving considerable in expense of repairs, and it is also far more pleasant for the employes.

The Brush Electric Light Company, of Rochester, purchased the entire lower falls of the Genesee River (which is about two miles from the business center of the city) some nine years ago. At that time it was looked upon by many as a piece of folly to think of running dynamos there, on account of the distance from the business center of the city and the dampness around the falls. Notwithstanding the adverse opinions, they erected two buildings on the west side of the river, above and near the brink of the falls, and put in two 30½ inch, two 20 inch, and one 40 inch turbine, the first four mentioned turbines under 94 feet head and the latter under 28 feet head, with a total of 2,500 horse power. After running this power for five years they built a new station and leased their old power to different parties for pulp and flour mill purposes.

ELECTRICITY AT THE WORLD'S FAIR.

J. A. Hornsby, a representative of the World's Fair, said that there is to be an electrical building, 700 feet long by 350 feet wide, having 240,000 square feet of floor space, and to cost $650,000 under contract. It is to be in the Italian renaissance architecture. Electric launches will be there, and an electric railway will traverse the ground. There will be a 24,000 horse power plant—a large one, that you gentlemen well know. The distribution from here will be in three directions. From this plant will be served 8,000 arc lamps, 8,500 incandescent lamps, and 4,000 horse power for operation of the machinery belonging to exhibitors. The exposition company will spend $26,000,000, the United States government $1,500,000, the States and Territories have already subscribed $5,000,000—two or three special State exhibits. This is not including $5,000,000 which have been subscribed by foreign governments for the maintenance of their exhibits. The South

American states alone have subscribed $2,700,000 for their share.

I have been in correspondence for six months or thereabouts with electrical people in all parts of the world relative to the holding in Chicago in 1893 of an international electrical congress. I have arrived at a point in our correspondence and negotiation at which I can say the project is in the way of being successful beyond our highest hopes. We look for the presence in Chicago at that time of the ablest men in the greatest profession now in existence. The Europeans have promised to have their very highest authorities with us.

T. C. Martin said: Two and a half years ago, at least, at any rate before it was known that the World's Fair would go to Chicago, and when some of us still fondly hoped that it would not, the American Institute of Electrical Engineers, taking time by the forelock, appointed a committee to secure the holding of an Electrical Congress or conference in this country. A congress was then about to be held in France, at Paris, at the exposition, and we sent delegates to that congress. Those delegates—some of our most prominent electrical engineers and inventors, among them being Mr. Edison, Prof. Elihu Thomson and others of that rank—extended in the name of the Institute to the delegates to that Electrical Congress an invitation to attend such a congress in this country during the Columbian Fair year. The invitation was received and accepted.

THE GRAND FALLS OF LABRADOR.

Dispatches to the Associated Press bring intelligence of the complete success of the Bowdoin College scientific expedition to Labrador in search of the Grand Falls of that region.

The schooner Julia Decker arrived at Hawkesbury, C. B., Sept. 11, having on board the members of the Bowdoin scientific expedition. The results of the trip to Labrador have far exceeded the hopes of the projectors. Grand Falls have been discovered and photographed, and, though not as high as reported, present a beautiful sight. The total fall is upward of 500 feet, divided into one fall of 200 feet and six rapids and cascades varying from 100 feet to 25 feet.

The exploring party of four men, all graduates of the college, headed by Austin Cary, left their schooner on Sunday, July 26. They were provided with two Rushton boats and all the modern instruments for measuring heights and distances.

Their success in navigating the river far exceeded their expectations, and such good progress was made that on August 8 they had passed Lake Waminikapou and had reached a point five miles in advance of the furthest point reached by Mr. Holme in 1888. At this place, on account of a disabled arm, Mr. Young and a companion were obliged to turn back, reaching Rigolet on August 21.

Messrs. Cary and Cole proceeded on toward the falls, which had been reported to be distant fifty miles. After going a short distance they were obliged, on account of the rapidity of the current, to leave their boat and make the journey on foot. From this point their progress was necessarily very slow, the woods being very thick and the mosquitoes and black flies almost unbearable. The explorers found the falls to be much further away than they had expected, but on August 13, after a three days' tramp, their labors were rewarded by a deafening roar in the distance. Their provisions were now nearly gone, stores having been cached on the way up, but they pushed resolutely on to the height of the Labrador plateau called "The Height of Land." It is this plateau which is the source of the stream, and the descent of the river to the sea forms the falls and rapids.

As they neared the falls a magnificent sight spread before them. The spray, which was visible for twenty miles, rose in a cloud from the descent of the water, and the solid rock beneath their feet trembled perceptibly. From the falls the water flows through a cañon formed of arcnaen rock, the sides of which rise to a height of 500 feet and are heavily wooded at the top. Through this cañon the water flows with terrific force, making it absolutely impossible for any boat to live in such a sea. The height of the falls has been exaggerated, and, while presenting a grand and beautiful sight, the falls measure only 200 feet in the perpendicular. The rapids increase the total altitude of the falls to 500 feet.

Above the falls the width of the river is 500 yards, narrowing until it reaches the falls to a width of only 50 yards, when it plunges with a terrific roar over the rapids and falls into the narrow gorge below. Mr. Cole descended to the foot of the falls and succeeded in obtaining some good photographs of them. Having completed the observations of the falls, the explorers kept on a few miles above to the Height of Land, were, from a peak christened by them Mount Hyde-Bowdoin, they had a fine prospect of the surrounding country. The plateau is nearly all wooded, with a thick, though not large, growth of soft timbers.

At this point, their provisions being all but gone, they set out for a return. On reaching the point where they left their boat, they found that the camp fire which they had built had consumed their boat, and with it their whole stock of provisions, a gun, and an octant. There position was now somewhat critical. Three hundred miles on a river heretofore unexplored, with no boat, no help, and no provisions until they would reach their first cache. They set bravely to work, however, and with a small hatchet for their only implement, constructed a small raft, binding the logs together with spruce roots. On rafts made in this way they traversed the 300 miles to the mouth of the river, enduring the greatest hardship.

Their only weapon was a small revolver, for which they had but twenty-five cartridges. With it they shot a few squirrels, making a meal on each animal. On the way down five different rafts were constructed, the making of which, in their wasted condition, consumed a great amount of time and energy. They reached the vessel Sept. 1, receiving a royal welcome from their friends.

The falls which they have discovered are reported to have been seen by two employes of the Hudson Bay Company, but no authentic account of any such discovery has been given. The successful result of the expedition is due wholly to the heroic efforts of Messrs. Cary and Cole, and Bowdoin College may well be congratulated by her sister colleges for the addition which she has made to the heretofore scant knowledge of the geography of Labrador.

LEPROSY.

Leprosy, that "unclassified fossil in the paleontology of disease," as Sir Morell Mackenzie aptly terms it, though far more prevalent throughout the world at present than it was a century ago, is still, by medical men, a shunned and neglected contagion. I use the word *contagion* advisedly, and in the sense of "an infection," as given it by lexicographers. Though New Orleans and San Francisco have their leper colonies and lazar houses, though the appearance of sporadic cases is not uncommon in our northeastern cities, still in the United States, as elsewhere in Anglo-Saxondom, the disease continues to be regarded and treated as incurable, and as only to be put out of sight and out of mind. Notwithstanding our regular trade with the West Indies, New Brunswick, Mexico, the Sandwich Islands, China, and India—all of these being forcing-houses from which the disease is supplied to the world at large—the medical profession in this country continues to ignore the disease, and only appears to be aware of its existence when the detection of one or two cases is announced in some center of population, as recently happened in the case of the two Chinamen in New York. Then the theories advanced are only limited by the number of doctors who rush into the arms of the interviewers, and the almost total ignorance which they exhibit is detected by most of their readers, though it is most apparent to one who has for a time dwelt in countries where leprosy abounds.

That leprosy has become firmly fastened in the Western World, and is no longer to be regarded as the scourge of "Bible lands" alone, is only too evident to any resident or leisurely traveler in tropical America; and even among the Creoles of Louisiana, the Chinese of California, the Scandinavians of Minnesota and Wisconsin, and the Mormon converts from the Sandwich Islands at Salt Lake, the disease now has a hold that is likely to be most difficut to overcome. Its very rapid spread throughout the countries under Anglo-Saxon rule has been pointed out by many English and German writers of note. When so eminent a specialist as Sir Morell Mackenzie says that "it is impossible to estimate even approximately the total number of lepers now dying by inches throughout the world, *but it is certain that they must be counted by millions*," and then adds, "That leprosy has spread considerably in recent times there can be no manner of doubt. . . . The seeds of leprosy take something like half a century to mature, and there is every prospect that unless the natural evolution of the scourge can in some way be prevented, a terrible harvest will be reaped *before many years are past*," it is time that our National Board of Health or some competent authority should begin a systematic and thorough inquiry into and examination of the disease.

But four centuries have passed since there were 250 lazar houses in England alone, over 2,000 in France, and probably about 11,000 throughout all Europe. Then laws governing lepers were as carefully framed and as rigidly enforced as any on the statute books. In Oahu, near Honolulu, the advance guard of the coming scourge was first observed by Dr. Hillebrand in 1853. The disease was not officially recognized until 1859, when only a few cases were known to exist. Yet in six years the known cases had increased to 230 by government count, and the situation was becoming so serious that in the following year the segregation settlement at Molokai was opened. Since that over 3,500 cases have been received there; the place has become world famous by reason of the self-denial, the life and the wretched death of the Belgian missionary priest, Joseph Damien de Veuster, commonly called "Father Damien." Going as a volunteer to minister to both the bodily and mental wants of these isolated wretches, starting in the prime and very flower of perfect manhood, but a short time had elapsed before we hear him beginning his address to his little flock with the words "We lepers." Yet a few years more and the sad story is ended, as he writes in his last letter to a friend, "I try to carry without much complaining and in a practical way the long foreseen miseries of this disease." It is inconceivable that Damien and his assistants should not avail themselves of every known appliance, treatment, and precaution whereby to avert the dangers of the contagion, yet, picked as they were from the healthiest volunteers, we find his death soon followed by the attack of his chief assistant, the doctor in charge, and of 66 *kokuas*, or helpers, 26 are known to have contracted the disease, and in nearly a score more it is reasonably suspected. In the West Indies the disease has been rapidly extending its ravages for at least 75 years back. In that space of time, in Trinidad, leprosy has increased nearly four times as rapidly as the population. In British Guiana there was, two years ago, one leper in every 250 of the inhabitants, their death rate was 16 per cent, and the disease was reported by the chief medical authority to be "spreading with great rapidity." Mr. Edward Clifford, who has given much attention to the present rapid spread of the disease, is confident that 250,000 cases is a moderate estimate for India. The present state of affairs in China beggars description and defies computation. In Canton alone one lazar house contained 900 lepers in 1887, and 2,600 victims were known to be at large in the city. Do not these facts point in one direction? Are we to calmly await such another outbreak as Europe saw between the 8th and the 13th centuries, when the disease in certain years slew its tens of thousands and became so prevalent among the better classes that the Order of St. Lazarus, governed only by lepers, with its chief house in Jerusalem, numbered its chapter houses by the scores throughout Europe, and at last became one of the wealthiest bodies of the time, so great was its power to extort alms from all classes? No doubt the diet and the habits of life to-day are far in advance of that of five centuries ago, but the examples of the difficulty that is experienced in stamping out the contagion, even under the most favorable sanitary conditions, are ample; and while Norway's experience in the last 50 years has taught us what segregation, reasonable diet, and extreme cleanliness will do, it has also proved that time and eternal vigilence are potent factors in this problem. Why then shall we wait for the rapid increase of the disease in the more favored localities in this country—an increase that is bound to come in time if the present reign of neglect continues?

H. P.

Locomotive Explosion.

At Oyster Bay, Long Island, on September 9, the boiler of a 46 ton passenger locomotive exploded, killing the engineer and fireman and one brakeman. The body of the engineer was thrown two hundred feet away to the south of the track, while that of the fireman was thrown a hundred and fifty feet to the north, and the body of the brakeman was thrown over and twenty feet to the rear of the train, which consisted of three cars. The brakeman was on the tender, and the engineer and the fireman were in the cab, the train standing at the depot just ready to start, when the explosion occurred. The crown sheet of the firebox, with a portion of the cab, were thrown about a hundred and fifty feet away, while the locomotive was left in a nearly vertical position, its front portion being partially forced into the ground. The explosion was evidently in the water chamber over the firebox, but its cause is unexplained, although it is reported that the dead engineer had said the riveting in the crown sheet and some of the outer plates of the firebox was defective. The locomotive was built in 1889 and had been overhauled a few months ago.

Producing Marbled Surfaces.

This method, by Soren C. Madsen, of Sleepy Eye, Minn., is as follows: Place a piece of clear glass over a sensitized surface (paper or otherwise). Then sprinkle on the upper surface of the glass, in irregular patches, sand, broken glass, and broken smoked glass, with the smoke partially rubbed off in places. This material must be so distributed as to leave the surface of the glass almost clear in spots and nearly opaque in others. Then expose to the direct undiffused sunlight, or artificial light, and the marbled appearance will be produced or printed on the sensitized surface.

Converting Iron into Steel.

W. Hodge says this process is a modification of the ordinary method of cementation, and differs from it in the substitution of carbonized or partially charred spent tan for the charcoal generally used. It is claimed that the resulting steel is not blistered and that the grain of the iron bars is not deleteriously affected, so that the reheating or remelting is unnecessary. Articles of wrought iron may also be case-hardened by this process.

Recent Mining Excitements.

The present year seems to be unusually prolific of mining excitements in the Far West. During the past month two new ones have blazed forth, the scene of one being the Pine Nut district in Nevada, and that of the other, La Plata in Utah. Concerning the former there is considerable mystery, as the tunnel in which the original (and so far, apparently, the only important) discovery was made is barricaded, and none but those interested are allowed to examine the breast. The stories of the wealth exposed there are, however, comparable only to the tale of Aladdin's cave. As was to be expected, there has been a rush from other mining camps of Nevada to the new district. Claims have been located in all directions, and with customary promptness several companies with large capital stocks have been organized in San Francisco to exploit property in the new field. Pine Nut is located in Douglass County, and is but a short distance from Austin.

La Plata camp, in Bear Gulch, Cache County, Utah, about 25 miles northeast of Ogden, has been heralded as a new Leadville. Ore was discovered at this place about one month ago by a sheep herder, whose sheep wore a path denuding the outcrop of a vein of rich lead ore. From the La Plata claim, located on this vein, the town which has since been established takes its name. This discovery being near Ogden and Salt Lake City, a stampede to the locality immediately followed the first news. It is estimated that within a week there were 500 men in Bear Gulch, where a town site had been laid out, saloons and gambling houses had been put in full blast, and, according to press reports, the place had taken on the look of a typical Western mining camp of five-and-twenty years ago.

The original discovery at La Plata has been followed by several others, and the district is said to be a promising one. As yet little is known concerning the nature of the veins which have been exposed. The formation is reported to be lime and porphyry, and the ore to bear lead and copper, carrying silver. No more definite information has yet been received.

Of the other new mining districts of 1891, Oro Grande, in Southern California, is still the scene of considerable activity; and there seems to be fair probability that some of the prospects there may be developed into mines. The discoveries at Oro Grande have attracted much attention to the mineral resources of Southern California; and there is more exploration work doing among the silver veins of San Bernardino County this year than for a long time past. The region is of considerable promise, and we may look for a gradually increasing product of silver in California as its resources are developed.

The excitement over the Deep Creek region of Utah and Nevada, which was the theme of interest three months ago, has almost entirely faded away. One mine there, the Buckhorn, is, we believe, making regular ore shipments, and others are sending occasional small lots to market; but the discoveries have not been of such a nature and extent as to warrant the immediate construction of a railway into the region; and its inaccessibility, lack of water, and other natural obstacles to profitable mining appear to have discouraged the influx of additional prospectors, or investments of capital in large developments, when there was no longer immediate prospect of a railway.—*Eng. and Min. Jour.*

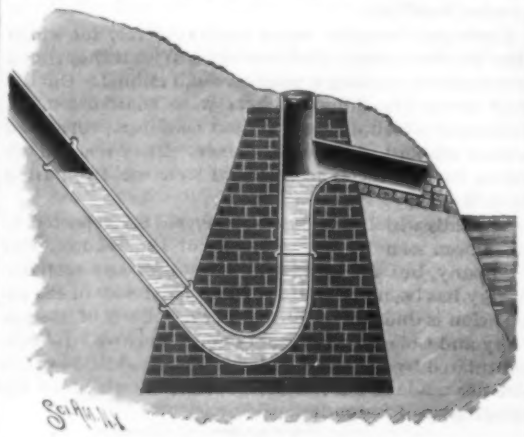
Irrigation by Steam Pump.

Where years ago it might not have been, it is now possible to irrigate many fair and productive acres by pumping, and thereby be independent of all the present systems of water courses and charges. A gentleman who has a Byron Jackson centrifugal pump upon his place, says the Bakersfield *Californian*, has made a careful observation as to cost and capacity of this kind of work. The plant will cost as follows: Engine, $900; pump, $200; freight, $200; average well, say $200; or $1,500 for plant. With thirty feet lift, the pump has a capacity of one cubic foot per second, and with ten or twelve feet lift, two cubic feet per second. The water should be used direct from the pump, as, if a storage reservoir is used, there is additional expense, and loss of water from seepage and evaporation. With small ditches and attention, one cubic inch of water per second is ample for 160 acres in vines and trees, and while using the pump it will keep two men busy handling the water, for, properly applied, from seven to eight acres can be irrigated each day. If alfalfa is laid out in narrow checks, so that the water can gently run over it, three acres a day can be irrigated in this manner. Of course, if flooding be practiced, each acre will require the old amount of one and one-fourth cubic feet per second for twenty-four hours.

The costs of running this pump are one cord of four-foot wood, $2.50 (or three loads of sage brush at about the same cost); labor running engine, $1.65; incidentals, 35 cents; a total of $4.50 for, say, seven and one-half acres, or 60 cents per acre. The engine of fifteen horse power is ample for a pump of double the capacity given above, and the said pump only costs $100 more originally.

IMPROVED SEWER AND DRAIN PIPE OUTLET.

Sewers and other drain pipes, emptying into rivers and streams whose banks are unstable, frequently cause the washing away of the bank to an extent to injure the pipes or obstruct the outlet. To obviate this difficulty the improvement shown by the accompanying illustration has been invented and patented by Mr. James H. Elliott, of the city engineer's office, Memphis, Tenn. A suitable abutment is constructed near the outlet, and the main drain pipe enters this abutment at an incline, then

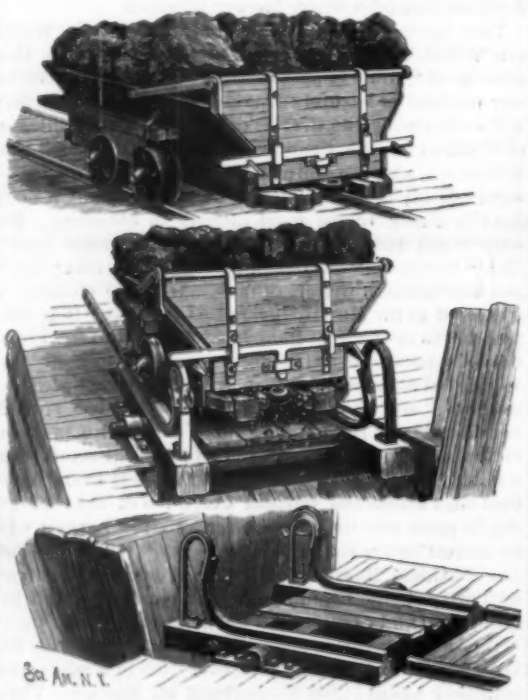


ELLIOTT'S OUTLET FOR DRAIN PIPES.

bends upward to a point near the top of the masonry, when it again bends outward, to discharge the flow into a paved gutter above low water mark. The vertical portion of the pipe is also continued upward to the surface, where it has a removable cover or grating to facilitate inspection and cleaning. The water always remaining in the lower bend of the pipe is designed to break the force of a rushing torrent, and prevent violent outflow, the masonry or concrete wall holding the pipe permanently in place.

AN IMPROVED MINING CAR AND TIPPLE.

The illustration represents a car and tipple, with automatically opening and closing latch, which has been successfully employed in practical work for some time past in Clearfield and Indiana counties, Pa., and is highly spoken of by miners in the soft and hard coal regions. It has been patented by Mr. Cornelius Burns, of Burnside, Pa. The first figure represents a loaded car with its gate at the rear held closed by the latch, the second view showing the latch as raised before dumping, and the third view showing the tipple. The gate is pivotally held on a transverse rod, and on its outer face are keepers in which a latch-bar is loosely held, its outer ends being engaged by latches extending rearward from each side of the car. The tipple, or



BURNS' MINING CAR AND TIPPLE.

tilting platform, has rails in line with those of the mine system, and the rails are curved upward at their outer ends, on which are bolted curved extensions or goosenecks, the outer portions of which are carried down vertically and bolted to the platform beams. A removable cap is held on one or both of these curved extensions by a rod with a projecting eye, by which the cap may be tightened or loosened or entirely removed. As a loaded car is run on the tipple, and its rear wheels come against the curved rails, the latch-bar strikes the curved extensions, and is thereby disengaged, the door swinging open as the car tips downward on the tipple, to discharge its contents into the chute. After the car is unloaded it comes back to a horizontal position by its own weight, the door closing and latching itself as the car returns to a level. Many advantages are claimed for this improvement over the old style of car and tipple. The latch is not liable to open in the mines, it does not require to be lifted by an operator in discharging the load, and the cost to remodel old cars and tipples to conform to this style need be but slight.

American and Canadian Railroads.

I do not believe that the extreme measure of requiring a license of the Canadian railroads to do business as part of lines connecting points in this country, and authorizing the abrogation of such license if they shall be held to have violated the Interstate Commerce law, is either wise or necessary. The power should never be granted to any one man or any body of men to put a stop to the business of a great railroad. In such case it is not the railroad or its stockholders that would be the chief sufferer, but the men who have made their business arrangements dependent upon the service which the railroad is to render them. I do not believe that the great cities or the great manufacturing districts of New England, that Buffalo, Toledo, Rochester, St. Paul, Minneapolis, the great cities of the Northern Pacific, or even Chicago or New York, would long submit to such an arrangement.

It is said also that by helping build up the railroad system of Canada, we create what would be a great military danger to us in case of war with Great Britain. On the contrary, it seems to me that we are getting a hostage which will forever bind Canada and Great Britain, so far as she cares for Canada, to good behavior toward us. All the property of the Canadian railroads, or which Canadian or British capital have invested in connecting lines in the United States, at once becomes worthless to them and a means of attack to us if war breaks out. The five million people of Canada are stretched out along the boundary line of nearly four thousand miles, if you follow its curves. I suppose nine-tenths of them dwell within an average of less than fifty miles from the American border. Their lines of railroad could be taken possession of by a military force in many places, if we find it necessary to do it. Canada is a chain easily severed in a hundred places. When she is broken at one point, she is broken at all. Our population is to hers as at least thirteen to one. Our wealth, our military resources, our power of producing military equipments and supplies, exceed hers in a vastly larger proportion. On the other hand, our transcontinental communications can be maintained in spite of anything that Canada or England could bring against them. It is said that special action may be taken by the British or Canadian government to enable their roads to underbid ours. If that happens, we shall know how to take care of ourselves, and the more interest they have in the American connection, the more they get into our power. No such action yet appears, or seems likely.

American railroads are as much entitled to protection against foreign hostility or unfair competition as any other form of capital or of labor. The railroads of the United States employ at least 850,000 persons, who in their turn have dependent upon their labor at least 5,000,000 persons, a thirteenth part of the population of the United States. The operating expenses of the railroads of this country were $352,000,000 in 1880. The figures for 1890 are not yet accessible, but there must have been an increase in this respect of from thirty to fifty per cent in the past ten years. Of this vast sum more than one-half is paid directly for labor, without reckoning the cost of labor which enters into the price of equipment, supplies and materials used during the year.—*Senator Geo. F. Hoar, in The Independent.*

Iron Paper.

It will not, perhaps, be remembered, says the *Paper Maker* (London), that in the great exhibition of 1851 a specimen of iron paper was exhibited. Immediately a lively competition ensued among ironmasters as to the thinness to which cold iron could be rolled. One ironmaker rolled sheets the average thickness of which was the $\frac{1}{1800}$ part of an inch. In other words, 1,800 sheets of this iron, piled one upon the other, would only measure one inch in thickness. The wonderful fineness of this work may be more readily understood when it is remembered that 1,200 sheets of thinnest tissue paper measures a fraction over an inch. These wonderful iron sheets were perfectly smooth and easy to write upon, notwithstanding the fact that they were porous when held up in a strong light.

It is claimed the steamer Majestic is the most economical coal burner of any of the Atlantic "high fliers." She burns 220 tons of coal a day, shows 19,500 horse power, and makes an average of over 20 knots, or 23 miles, per hour throughout the Atlantic passage. There are only two other ships that have reached this speed, namely, the duplicate ship the Teutonic and the City of Paris. But there are a few other vessels that come near this speed.

THE SYSTEM OF MILITARY DOVE COTES IN EUROPE.*

France.—The history of the aerial postal service and of the carrier pigeons of the siege of Paris has been thoroughly written, and is so well known that is useless to recapitulate it in this place. It will suffice to say that sixty-four balloons crossed the Prussian lines during the war of 1870–1871, carrying with them 360 pigeons, 302 of which were afterward sent back to Paris, during a terrible winter, without previous training, and from localities often situated at a distance of over 120 miles. Despite the shooting at them by the enemy, 98 returned to their cotes, 75 of them carrying microscopic dispatches. They thus introduced into the capital 150,000 official dispatches and a million private ones reduced by photo-micrographic processes. The whole, printed in ordinary characters, would have formed a library of 500 volumes. One of these carriers, which reached Paris on the 21st of January, 1871, a few days previous to the armistice, carried alone nearly 40,000 dispatches.

The pigeon that brought the news of the victory of Coulmiers started from La Loupe at ten o'clock in the morning on the tenth of November, and reached Paris a few minutes before noon. The account of the Villejuif affair was brought from Paris to Tourcoing (Nord) by a white pigeon belonging to Mr. Descampes. This pigeon is now preserved in a stuffed state in the museum of the city. The carrier pigeon service was not prolonged beyond the 1st of February, and our winged brothers of arms were sold at a low price at auction by the government, which, once more, showed itself ungrateful to its servants as soon as it no longer had need of their services. After the commune, Mr. La Perre de Roo submitted to the president of the republic a project for the organization of military dove cotes for connecting the French strongholds with each other. Mr. Thiers treated the project as chimerical, so the execution of it was delayed up to the time at which we saw it applied in foreign countries.

In 1877, the government accepted a gift of 420 pigeons from Mr. De Roo, and had the Administration of Post Offices construct in the Garden of Acclimatization a model pigeon house, which was finished in 1878, and was capable of accommodating 200 pairs.

At present, the majority of our fortresses contain dove cotes, which are perfectly organized and under the direction of the engineer corps of the army.

The map in Fig. 1 gives the approximate system such as it results from documents consulted in foreign military reviews.

According to Lieutenant Gigot, an officer of the Belgian army, who has written a very good book entitled *Science Colombophile*, a rational organization of the French system requires a central station at Paris and three secondary centers at Langres, Lyons and Tours, the latter being established in view of a new invasion.

As the distance of Paris from the frontier of the north is but 143 miles at the most, the city would have no need of any intermediate station in order to communicate with the various places of the said frontier. Langres would serve as a relay between Paris and the frontier of the northeast. For the places of the southeast it would require at least two relays, Lyons and Langres, or Dijon.

As Paris has ten directions to serve, it should therefore possess ten different dove cotes of 720 birds each, and this would give a total of 7,200 pigeons. According to the same principle, Langres, which has five directions to provide for, should have 3,600 pigeons.

Continuing this calculation, we find that it would require 25,000 pigeons for the dove cotes as a whole appropriated to the frontiers of the north, northeast, east, and southeast, without taking into account our frontiers of the ocean and the Pyrenees.

A law of the 3d of July, 1877, supplemented by a decree of the 15th of November, organized the application of carrier pigeons in France.

One of the last enumerations shows that there exist in Paris 11,000 pigeons, 5,000 of which are trained, and in the suburbs 7,000, of which 3,000 are trained. At Roubaix, a city of 100,000 inhabitants, there are 15,000 pigeons. Watrelos, a small neighboring city of 10,000 inhabitants, has no less than 3,000 carrier pigeons belonging to three societies, the oldest of which, that of Saint-Esprit, was founded in 1869.

In entire France, there are about 100,000 trained pigeons, and forty-seven departments having pigeon fancying societies.

Germany.—After the war of 1870, Prussia, which had observed the services rendered by pigeons during the siege of Paris, was the first power to organize military dove cotes.

In the autumn of 1871, the Minister of War commissioned Mr. Leutzen, a very competent amateur of Cologne, to study the most favorable processes for the recruitment, rearing and training of carrier pigeons, as well as for the organization of a system of stations upon the western frontier.

In 1872, Mr. Bismarck having received a number of magnificent Belgian pigeons as a present, a rearing station was established at the Zoological Garden of Berlin, under the direction of Dr. Bodinas.

In 1874, military dove cotes were installed at Cologne, Metz, Strassburg and Berlin. Since that time there have been organized, or at least projected, about fifteen new stations upon the frontier of France, upon the maritime coasts of the north, or upon the Russian frontier.

Berlin remains the principal rearing station, with two pigeon houses of 500 pigeons each; but it is at Cologne that is centralized the general administration of military dove cotes under Mr. Leutzen's direction.

Fig. 1.—THEORETIC MAP OF THE FRENCH SYSTEM OF MILITARY DOVE COTES.

The other stations are directly dependent upon the commandant of the place, under the control of the inspector of military telegraphy. The Wilhelmshaven dove cote, by way of exception, depends upon the Admiralty. In each dove cote there is a subofficer of the engineer corps and an experienced civil pigeon fancier, on a monthly salary of ninety marks, assisted by two orderlies. In time of war, this *personnel* has to be doubled and commanded by an officer.

The amount appropriated to the military dove cotes, which in 1875 was about 13,000 francs, rose in 1888 to more than 60,000 francs.

As a rule, each dove cote should be provided with 1,000 pigeons, but this number does not appear to have been yet reached except at Thorn, Metz and Strassburg.

Germany has not confined herself to the organization of military dove cotes, but, like other nations, has endeavored to aid and direct pigeon fancying, so as to be able, when necessary, to find ready prepared resources in the civil dove cotes. The generals make it their duty to be present, as far as possible, at the races of private societies, and the Emperor awards gold medals for flights of more than 120 miles.

On the 13th of January, 1881, nineteen of these societies, at the head of which must be placed the Columbia, of Cologne, combined into a federation. At the end of the year the association already included sixty-six societies. On the 1st of December, 1888, it included seventy-eight, with 52,240 carrier pigeons ready for mobilization.

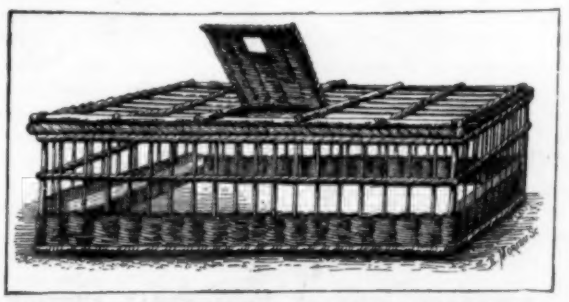


Fig. 2.—BASKET FOR CARRYING PIGEONS.

The first two articles of the statutes of the Federation are as follows:

"I. The object of the Federation is to unite in one organization all societies of pigeon fanciers in order to improve the service of carrier pigeons, which, in case of war, the country must put to profit.

"II. The Federation therefore proposes: (*a*) To aid the activity of pigeon fancying societies and to direct the voyages of the societies according to a determined plan; (*b*) to form itinerant societies and on this occasion to organize expositions and auction sales of pigeons; (*c*) to maintain relations with the Prussian Minister of War; (*d*) to obtain diminutions and favors for transportation; (*e*) to make efforts for the extermination of vultures; (*f*) to obtain a legal protection for pigeons; and (*g*) to publish a special periodical for the instruction of fanciers."

Italy.—The first military dove cote in Italy was installed in 1876, at Ancona, by the twelfth regiment of artillery. In 1879, a second station was established at Bologna. At present there are in the kingdom, besides the central post at Rome, some fifteen dove cotes, the principal ones of which are established at Naples, Gaeta, Alexandria, Bologna, Ancona and Piacenza. There are at least two on the French frontier at Fenestrella and Exilles, and two others in Sardinia, at Cagliari and Maddalena. The complete system includes twenty-three; moreover, there are two in operation at Massoua and Assab.

The cost of each cote amounts to about 1,000 francs. The pigeons are registered and taken care of by a pigeon breeder (a subofficer) assisted by a soldier. The head of the service is Commandant of Engineers Malagoli, one of the most distinguished of pigeon fanciers.

We represent in Fig. 2 one of the baskets used in France for carrying the birds to where they are to be set free.—*La Nature.*

Health Experiments with Explosives.

Complaints having been made by those engaged in coal mines where modern "high explosives" were used for blasting, that the fumes produced by the explosion of these bodies were deleterious, a committee was appointed in September, 1889, by the Durham Coal Owners' Association, consisting of representatives of both masters and men, with two of H. M. Inspectors of Mines, to consider the question, and report whether the fumes produced by the combustion of tonite and roburite were injurious to health. Power was given to the committee to call in professional advisers, and careful experiments were made.

The general conclusions arrived at by the experts were that (1) the fumes produced by tonite and roburite are not more dangerous than those from gunpowder; (2) nitrobenzene is apparently not produced by the combustion of roburite; (3) the carbon monoxide produced is present only in traces; (4) an interval of five minutes should be allowed to elapse before the hewers re-enter the scene of firing; and (5) that, as a portion of the gases in the fumes come from the fuse, the charges should be fired by electricity.

A more modern explosive than roburite, and one which is similar in nature, is the new "ammonite." The main work of the committee was over before the introduction of this new body; otherwise, in view of the probable general use of ammonite for blasting, it would have been interesting to have examined the fumes produced by its combustion. Ammonite contains 81·5 parts of ammonium nitrate and 8·5 parts of mononitro-naphthalene. It is of equal projectile force to roburite, and superior to tonite in this respect. It cannot be exploded by concussion, and burns quietly on an ordinary fire. Its properties are not affected by freezing. It requires rather a large proportion of detonator to produce explosion.

The Caravel Santa Maria.

Among the exhibition attractions is to be a facsimile of the caravel Santa Maria, in which Columbus sailed. It is proposed to have this caravel as nearly exact as possible. It will be manned by Spanish sailors in the costume of the time of Columbus, and it will be rigged with the same sort of rigging that he used. There will be on board copies of the same charts that he had, facsimiles of the same nautical instruments. The crew will be of the same number, and it has been suggested that to carry out the truth of history there should be in the crew an Englishman and an Irishman, for according to Navarrete, the eminent Spanish historian, William Harris, an Englisman, and Arthur Lake, an Irishman, were members of Columbus' crew.

There will also be a notary on board wearing the ancient costume, and representatives of all other functionaries who accompanied Columbus.

It is proposed to have this vessel make its first appearance at the grand naval review which is to take place in the harbor of New York, where the little ship will be saluted by the monstrous cruisers of modern invention, representing all the navies of the world. At the close of the naval review it is proposed to have this vessel transferred, with ceremony, by the representative of the government of Spain, to the President of the United States, and then have it towed through the lakes and Welland Canal to Chicago, where it will be one of the most interesting features of the exposition.

THE Duluth *Herald* notes the unloading of 3,000 tons of coal from the steamer Gilcher at the Pioneer Fuel Company's docks in that city. It states further that this is the largest cargo of coal ever brought to the head of Lake Superior, the average being from 1,500 to 2,000 tons, and the maximum heretofore about 2,350.

* Continued from *Scientific American* of July 11, p. 23.

IMPROVEMENT OF POTOMAC FLATS, WASHINGTON.

The improvement of the river front of the city of Washington, D. C., popularly known as the Potomac Flats Improvement, was intended to accomplish two objects: First, to improve navigation, for which annually the government has for years been expending a large sum of money; and second, to fill up a large area of marsh land, which was overgrown with a dense growth of grass. The marshes were what are known as the Flats. There were many acres of these marshes bordering on the river bank, which were exposed at low and covered at high tide. One of the largest sewers of the city discharged its contents on these flats, and being exposed daily to the rays of the sun, when the tide was low, rendered a large section of the city almost uninhabitable. The Executive Mansion itself was only about 2,500 feet from the flats, which became such a public nuisance that what had been one of the most desirable sections of the city became the most undesirable for residence.

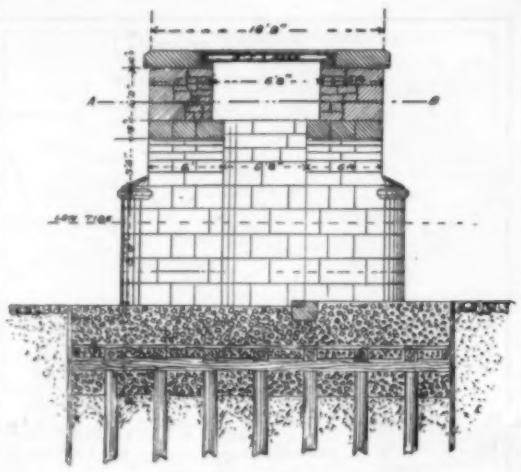
In 1881 the Senate appointed a committee to investigate the case. The direct result of this investigation was an appropriation by Congress of $400,000 to begin the work of improvement. Since then successive appropriations have been made at intervals of two years, and the amount expended up to the present time has been $1,624,798. The estimated cost of the entire work was $2,716,365, and, notwithstanding the unbusinesslike methods of Congress in appropriating insufficient sums to prosecute the work vigorously, and the damage it has consequently sustained from freshets, the work has been brought to that advanced state that it could yet be completed within the estimates. Considering the magnitude of the work, and the fact that the estimates were regarded as low, this is justly regarded as a satisfactory exhibit.

The total area of land reclaimed is in round numbers 611 acres. The material with which the fill was made was taken from the river channels, and thus accomplished the double purpose of improving the navigation and reclamation of the flats.

The question of the disposal of dredgings taken from rivers to improve navigation is becoming a serious one. The old dumping grounds are rapidly becoming filled up, and even when others are found at a long distance from the place to be improved, there is great danger of the material being swept back into some other channel, and thus create a new obstruction where none before existed. In many places satisfactory dumping grounds cannot be found at all; in others the vested rights of adjacent owners of land forbid it.

The work of taking the material from the bed of the river was done in different ways. At first the channels were dredged in the ordinary way, with clamshell and dipper dredges, the material being loaded into scows and then conveyed to a basin located at a convenient point, from which it was again taken up and loaded on railroad cars, which conveyed it to the place of deposit on the flats. The tracks in this case were carried on trestle work, made by driving piles in the flats on the area to be filled, and capping them with heavy timbers. The tracks were raised to a sufficient height to cause the material, when dropped from the cars, to fall with such force that it spread out laterally to a distance of several hundred feet, and when it did not spread itself, a pump was used to level it down. This method of deposit had several disadvantages. It was expensive. The amount of material that could be dropped at any particular point depended altogether on its character. Soft mud spread out well, but sandy or gravelly stuff did not. The material had to be lifted through a considerable vertical height no less than three times—a wasteful expenditure of energy.

Another method was to dredge the material from the river by means of a centrifugal pump, and force it ashore through pipes carried on scows or pontoons. This work we show at the top of our front page, the material being delivered under pressure to a considerable distance. The boat shown in the illustration is 110 feet long; beam of boat, 50 feet. The rotary centrifugal pump is 8 feet in diameter, and 21 inches discharge. Two engines are required to run the pump, each 22 inch cylinder and 24 inch stroke, making



RESERVOIR OUTLET—VERTICAL SECTION.

150 revolutions per minute; steam 90 pounds to the inch. Two locomotive boilers, each 60 inch diameter, 25 feet long. Two engines to run the plows, each 10×20, running 120 revolutions per minute, discharging through 4,200 feet in length of 20 inch discharge pipe.

This pump has a capacity of 10 cubic yards per minute in stiff blue clay and a greater capacity in other material. Three of these hydraulic dredges were put on the work at various times. The material dredged in this way when deposited on the flats spread itself out in low conical heaps and gave good grades. When the material was very soft it spread out quite flat. This method of dredging proved economical and advantageous, but it was necessary to prepare the place of deposit by constructing embankments around it. As these embankments became in fact a part of the fill and were cheaply constructed, the hydraulic method of dredging was very satisfactory. The centrifugal pump dredge was known as the McNee dredge, and has been used on other important work, giving good satisfaction. As it deepens the channel and deposits the material at any distance required up to one mile at one operation, it is by far the cheapest method that has been employed. Many of these dredges are now in use in different sections of the country. They are owned and operated by the Hydraulic Dredging and Improvement Company, of Philadelphia, Pa.

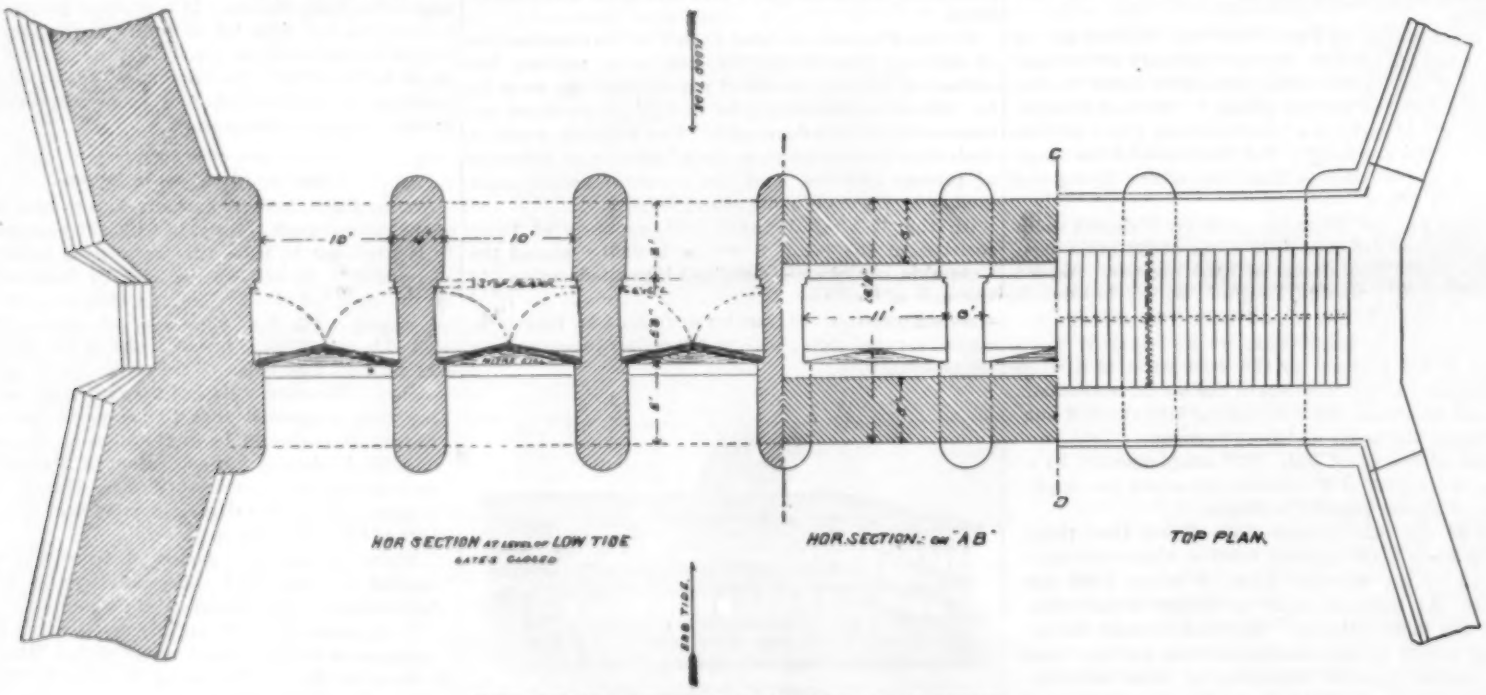
Another method was introduced at a later stage of the work, and consisted in dredging the material into scows and conveying it to a pump operated on the pulsometer principle. This pump was located near the margin of the flats, and set in a hole in the bed of the river. The dredged material was dumped into this hole, from which it was sucked up by the pump and forced into a chute which carried it out to the place of deposit. The mode of operating the pump was to fill a large cylindrical tank with steam, the pressure from which drove out any material in the tank, and raised it to the top of the chute into which it discharged. By means of a shower bath the steam was then condensed, which closed a valve in the discharge pipe and opened one in the suction. The latter being buried in the dredgings which were deposited over the end of it, and a vacuum being produced by the condensation of the steam in the tank, an inrush of mud or mud and water took place, soon filling the tank. It was then forced out as before. This method of dredging necessitated the construction of long chutes, and as the material had to run down by gravity, the end into which the pump discharged had to be high.

The filling of the flats converted the old Washington Channel into an arm of the river, closed at the upper end, into which some sewage would necessarily go. To purify this, a tidal reservoir of about 110 acres was constructed just above Long Bridge, from which about 200,000,000 gallons of water would be discharged daily into the head of the Washington Channel. The water is taken into the reservoir from the Virginia Channel on the flood tide and discharged into the Washington Channel on the ebb. To control this operation it was necessary to construct, near Long Bridge, the reservoir outlet, which is provided with gates that work automatically, closing on the flood and opening on the ebb tide. A set of inlet gates, to work on the same principle, may also be needed.

The reservoir outlet is a masonry structure, consisting of a breast wall perforated by six arched openings, with two wing walls on the upstream and two on the downstream side. Each opening is 10 feet wide and 13 feet to the crown of the arch, the bottom being 6 feet below mean low tide. The discharge area is therefore 360 square feet at low tide and 540 square feet at ordinary high tide. The gates, when closed, rest against miters at the bottom and top, and when open set back into a recess in the side walls. They are built of wood, and pivoted at the heel, so as to make the friction the least possible. No mechanism is needed to start the gates closing from their positions in the recess of the masonry; the action of the water does this automatically as soon as the tide begins to run up stream.

Considerable difficulty was experienced in securing a foundation for this structure. The bed of the river here consists of very soft mud to a depth of fifty to sixty feet, then layers of sand of varying thickness are encountered, with layers of mud between. At a depth of seventy-two to seventy-five feet a compact layer of gravel is found. As any unequal settlement would disarrange the gates, it was deemed necessary to drive piles to the latter depth. These were capped by two sets of grillage timbers, and the spaces between them, and for two feet below the heads of the piles, were filled in with concrete.

The total amount of material thus far dredged and deposited on the flats is in round numbers about 8,643,000 cubic yards. The price paid for dredging, exclusive of embankments, has varied from 12·37 cents to 21·2 cents per cubic yard, but besides the dredging there has been a large amount of stone used as a footing for



RESERVOIR OUTLET—HORIZONTAL SECTION.

the embankments, and foundations for protecting walls. The total cost of the entire work thus far, including everything, has been $1,624,798. The value of the land reclaimed, in its present condition, is estimated at not less than about $3,000,000, so that viewed as a commercial enterprise, it has been a profitable undertaking for the government.

One of the views shows the condition of the flats at low tide, as given by a photograph taken from the top of the unfinished Washington monument in October, 1883, when the monument had reached a height of 384 feet. Another view represents the improvement as it appears to-day, and was taken from the top of the present Washington monument. The diagram, drawn to a scale, gives the relative size and positions of different parts of the work, all of which has been done under the direction of Col. Peter C. Hains, U. S. A., in charge of various public works in the immediate vicinity of Washington, and to whom we are indebted for the details given.

From the Capitol to the Virginia Channel is now one large park, marred only by the unsightly tracks of the Baltimore and Potomac Railroad. Embraced in this area are the Botanical Gardens, Medical Museum, Smithsonian, Agricultural Department, Bureau of Engraving and Printing, and the Washington monument. This park is a favorite drive for the thousands of visitors to the capital, and the grounds of the White House border it on the northwest.

Something Queer in the Numbers.

Mr. John W. Kirk, the white-haired veteran who was with Morse when the first working telegraph line was stretched, and who stood beside the great inventor when the first message was transmitted from Annapolis Junction to Washington, has made, during his life, a great many interesting calculations in numbers. The two most remarkable numbers in the world are 3 and 7.

"The numeral 7," says Mr. Kirk, "the Arabians got from India, and all following have taken it from the Arabians. It is conspicuous in Biblical lore, being mentioned over 300 times in the Scriptures, either alone or compounded with other words. It seems a favorite numeral with the divine mind, outside as well as inside the Bible, as nature demonstrates in many ways, and all the other numbers bow to it. There is also another divine favorite, the number 3—the Trinity. This is brought out by a combination of figures that is somewhat remarkable. It is the six figures 142,857.

"Multiply this by 2, the answer is 285,714.
"Multiply this by 3, the answer is 428,571.
"Multiply this by 4, the answer is 571,428.
"Multiply this by 5, the answer is 714,285.
"Multiply this by 6, the answer is 857,142.

"Each answer contains the same figures as the original sum and no others, and that three of the figures of the sum remain together in each answer, thus showing that figures preserve the Trinity.

"Thus 285 appears in the first and second numbers, 571 in the second and third, 428 in the third and fourth, and 142 in the fourth and fifth.

"It is also interesting to note that, taking out of any two of these sums the group of three common to both, the other three, read in the usual order from left to right, will also be in the same order in both sums.

"Take the first and second sums, for example. The group 285 is common to both. Having read 285 out of the second sum, read right along and bring in the first figure of the thousands last. It will read 714. All the others will read in the same way.

"Again, note that the two groups of three in the first sum are the same as the two groups of threes in the fourth, reversed in order, and that the same thing is true of the second and third. The last multiplication has its groups of threes the same as those of the original number, reversed again.

"Examine these results again, and you will see that in these calculations all the numerals have appeared save the 9. Now multiply the original sum by the mighty 7—the divine favorite of the Bible and of creation—and behold the answer! The last of the numerals, and that one only in groups of three—again the Trinity!

$$\begin{array}{r} 142{,}857 \\ 7 \\ \hline 999{,}999 \end{array}$$

"No other combination of numbers will produce the same results. Does not this show the imperial multipotent numeral 7 and its divinity?"—*N. Y. Sun.*

A DOUBLY tin-lined and hermetically sealed box containing rubber coats has been in the Atlantic Bonded Warehouse, San Francisco, Cal., for some time. Recently it was found to be quite hot, and day after day the heat became more intense until it was decided to investigate. Finally a permit was got from the collector to open the box. It was taken from the building and opened with an ax. As soon as the fresh air struck the contents, flames leaped into the air for several feet and a cloud of smoke escaped. The rubber goods were mackintoshes containing some compound which caused spontaneous combustion.

Correspondence.

Concerning Steam Vessels.

To the Editor of the Scientific American:

A few weeks past I saw in your paper of the 18th of April, in our Howrah Institute, that you had made inquiries into the reason why your American cruisers fell short of keeping up the speed which they made on the four hours' trial. There can only be one answer; That the boiler power was not in the vessel. The engines can be made all sizes, but the boiler power must not be a sham, or failure is the result.

In the same paper you state a vessel is being constructed of the cruiser class, 7,400 tons displacement, and to have three screws, and the speed for four hours to be 22 knots and the indicated horse power 23,000. For a vessel of this displacement to steam 22 knots the engines would require to indicate 26,000 horse power, and the vessel would require to be of the following dimensions: Length, 450 ft.; breadth, 56 ft.; depth of hold, 36 ft.; mean draught, 23 ft. 6 in.; coefficient of fineness block, 0·45; midship section, 0·7854; angle of entrance, 10°.

Boilers twenty-two in number; diameter, 13 ft. × 18 ft.; four furnaces to each (double-ended boilers), having combustion chambers 4 ft. × 4 ft. common to both furnaces. Boilers to work under forced draught. Tubes 7 ft. long by 3¼ in. diameter. Total heating surface, one boiler, 3,500 sq. ft. Furnaces 3 ft. 6 in. diameter by 7 ft. long. Total grate surface, one boiler, 84 sq. ft. Total steam space in one boiler, 600 cu. ft. Working pressure, 180 lb.

Engines—three sets of triple expansion; sizes according to the number of revolutions to get up the indicated horse power, say for engine having 5 ft. stroke and to indicate 8,500 at 100 revolutions.

			Inches.	
100 rev. per minute, working pressure 180 lb., cylinders	40	60	100
120	"	"	"	"	"	36	56	95
130	"	"	"	"	"	35	55	92
140	"	"	"	"	"	34	53	88
150	"	"	"	"	"	34	50	86
160	"	"	"	"	"	33	48	83

Each set of these engines will indicate 8,500 H. P. on a consumption of 1·5 lb. of coal. Calculations made from a 110 in. cylinder, cutting off steam at ⅓ of stroke. Revolutions 130, working pressure 180 lb. steam.

Consumption of coal per H. P., 1·5 lb. per hour.

Diameter of screw shaft, 22 inches.

Diameter of propeller 16 ft., pitch 20 ft., for 160 revolutions.

Diameter of propeller 18 ft., pitch 28 ft., for 100 revolutions.

Angle of blade at tip 26°, at boss 4 ft. 6 in. diameter, angle 63° for propeller 18 ft. diameter, pitch 28, wing engines. Propeller for center engine 20 ft. diameter, pitch 30 ft., angle at tip 25° 30′, 5 ft. boss, angle at 62°.

The first set of cylinders, viz., 40 in., 60 in., 100 in., with propeller 18 ft. diameter, 28 ft. pitch, 100 revolutions, should be fitted in the wings of vessel; and engines having cylinders 45 in., 70 in., 106 in., with 6 ft. stroke, 100 revolutions, propeller 20 ft., pitch 30 ft., angle at tip 25° 30′, diameter of shaft 24 in., should be fitted to center of vessel.

The cost of a vessel of this class in England would, if built by Laird Brothers, Birkenhead, be about $2,750,000. W. WOODS, *Engineer Apprentice,*

Ahmuty & Co., Howrah Foundry, Calcutta.

Calcutta, August, 1891.

Underground Wires in China.

"A superstitious reverence for the dead accomplished years ago in China something that regard for the comfort and safety of the living, even when aided by judicial mandates and radical municipal methods, has been only partially able to accomplish in this country," said a telegraph lineman who was in the employ of the company that established the first telegraph line in China.

"The telegraph wires are placed underground there, and if the company had not so disposed of them there would have been no telegraph lines in China to this day. Dead ancestors are held in peculiar reverence in that curious country, and the casting of a shadow upon the grave of an ancestor is looked upon by the Chinese as an insult not to be borne, and it is always resented with impetuous rage. Now there are no cemeteries or general burying grounds in China, but every family's ancestors, particularly in the rural districts, are buried on the family premises. Consequently, every yard or garden is a receptacle of ancestral remains, and as China is thickly populated, the revered bones of the dead and gone Mongolian progenitors may be found resting beneath every few rods of earth. When the telegraph company went to work to put up the poles on which to hang its wires, the workmen were embarrassed every little while by wrathful Chinamen, who would rush angrily upon certain poles and chop them to the ground, and warn the workmen with much furious chatter that they would put them up again at their peril. The cause of this interference was unknown to the workmen, who were at last forced to discontinue the work, and explanation was demanded by the authorities. Then it was learned that the poles that were cut down had cast a shadow some time during the day on the graves of revered ancestors of Chinamen, and the insult could be wiped out in no other way but by summarily removing the poles. It was found that this superstition was too sacred a one among the Chinese to be overcome by persuasion or bribery, and at last the telegraph company, as a matter of economy and self-protection, laid their wires beneath the surface, where they have been ever since."

Forests.

"Did it ever occur to you to consider what an enormously valuable inheritance man has received in the 'forests primeval'? said Professor Fernow, of the Department of Agriculture, in conversation with a Washington *Star* writer. "Of all the natural resources received by nature for our benefit, they are the most directly useful. In the woods we find ready at hand and obtainable for mere harvesting materials applicable to all the needs and means to satisfy every immediate want.

"Probably you will be surprised when I tell you that the annual increase of the forests by natural growth, representing the interest which we are at liberty to draw without impairing the principal, exceeds in the United States alone ten times the value of the gold and silver output of this country, and is worth more than three times the product of all our mineral and coal mines put together. If to the value of our total mining product be added the value of all the stone quarries and petroleum resources, and this sum be increased by the estimated value of all the steamboats, sailing vessels, and canal boats plying in American waters, it will still be less than the value of the annual forest product of the nation by a sum sufficient to purchase at cost of construction all the canals, buy at par all stocks of the telegraph companies, pay their bonded debts, and equip all the telephone lines. The annual product of the woods is worth three times as much as the wheat crop. It exceeds the gross income of all the railway and transportation companies, and it would more than wipe out the entire public debt.

"More than 300,000 people are occupied to-day in the direct manufacture of forest and sawmill products alone. Were I to attempt an enumeration of the uses to which the product of the woods is put, it would be necessary for me to mention all the phases and employments of human life. Railways annually consume 500,000,000 feet of timber. The same material builds the houses and yields for two-thirds of the population the fuel necessary to warm their dwellings with and to prepare their food. Upon charcoal the iron industry largely depends. Not only in its natural form does the substance serve our needs, but our ingenuity has devised methods for transforming it into all sorts of useful things. Paper is made from it, and even silk, while it has become possible to prepare from brushwood a feed for cattle as nutritious as hay. By distillation are derived from it alcohol and acetic acid, while the barks yield indispensable tanning material, resin and tar for pitching vessels, turpentine, sassafras, oil, and cork.

"The decayed vegetation of forests has furnished to the fields their present fertility, upon which man depends for food. In the tree growth of virgin woods and in the floor of rotted foliage beneath are stored the accumulations of centuries. Nature does not care whether this growth is useful to the human race or not. It is left for us to encourage the growth of such trees as we find valuable, to the exclusion of others. Thus an economical use is made of the resources at hand and a new conception of the forest arises. The forest primeval becomes 'woodlands,' while the new 'forest' includes only cultivated woods.

"If left without interference by man, Nature would keep the entire earth covered with forests, save only a few localities. The treelessness of the great central plains of the United States has been accounted for by the deficiency of rainfall, and the belief is generally held that by reason of this lack of moisture trees can never grow there. Nevertheless the conclusion does not of necessity follow. There is excellent cause for believing that these prairies were not always treeless, and that their nakedness might once more be covered by the adoption of proper means to that end. The barrenness occasioned by prairie fires and herds of tramping buffalo may yet be made fruitful. You must remember that the entire earth is a potential forest. Wherever there is sufficient depth of any kind of soil for the roots, if it is not too frigid a climate and man does not interfere, arborescent growth will ultimately prevail on account of its perennial character and its power to shade out lower vegetation. In such localities as the interiors of large continents forest planting must progress by gradual advances from the borders of the unproductive territory. Once let woods be spread over the now arid plains of the West and there would be rain in plenty there. But success in this matter can only be achieved through co-operation systematically and methodically carried out, commanding knowledge, means, and power such as a government, whether of the nation or of States, can alone control."

THE LAVA PLAINS OF IDAHO.

BY PROF. G. F. WRIGHT, D.D.

The extent of the lava beds covering the surface west of the Rocky Mountains is almost incomprehensible, and until the facts were established by repeated observations the reports concerning them were regarded as incredible. But literally hundreds of thousands of square miles in British Columbia and southward along the Pacific slope and through the great interior basin to Mexico are covered with lava of a very recent age. Though there are no existing volcanoes in the region, abundant evidence exists that extensive volcanic eruptions have occurred there, not only since man appeared, but even within a few hundred years. But the most of the lava must have poured out of the earth, not in craters, but through extensive fissures, now buried beneath the abundant volcanic material that has come up through them.

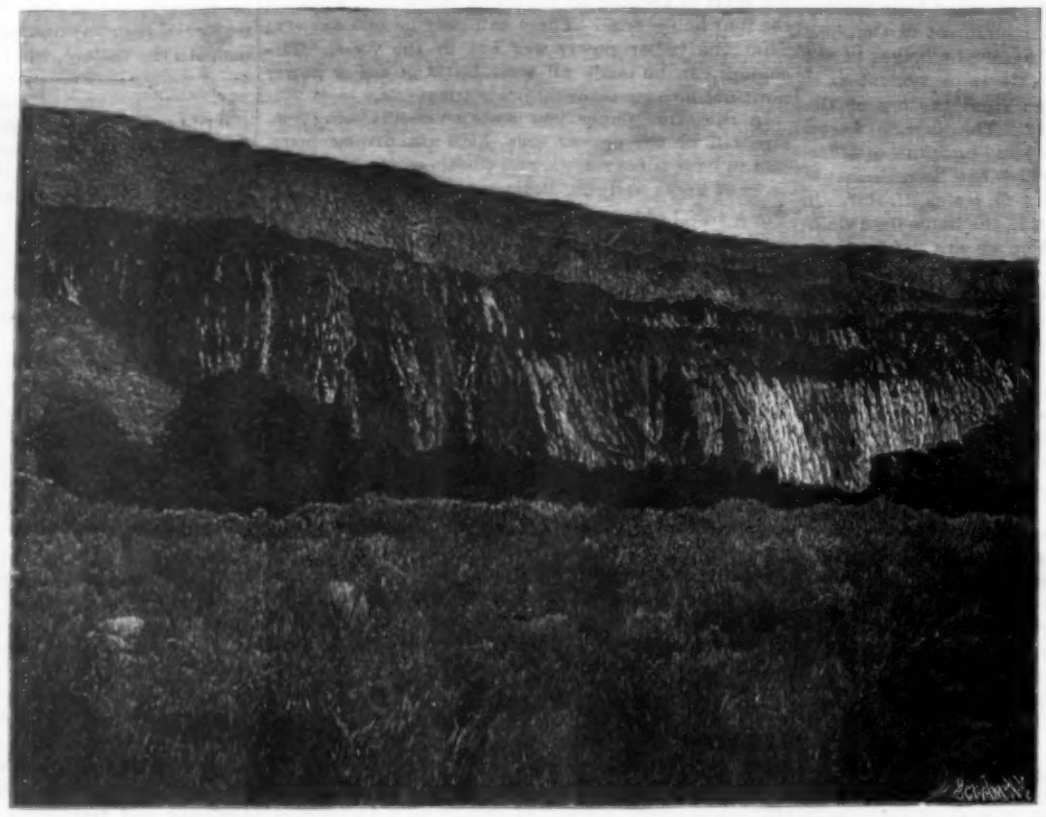
The lava deposits of Oregon and Washington are more extensive than those of Idaho, but it is hardly possible that they can be more interesting. The cañon of the Columbia River, where it has cut through the Cascade Mountains, between Oregon and Washington, is entirely in basaltic lava of recent geologic date, and is from 3,000 to 4,000 feet in depth. In Idaho the lava is largely limited to the Snake River Valley, which it has filled up to a definite level between the mountains on either side, looking, verily, like a vast lake which has been suddenly congealed in the midst of a storm. Not far from 12,000 square miles of this area consists of gently rolling swells of vast lava deposits, much of which looks as fresh as the slag which came out of the furnace but yesterday. Over hundreds of square miles there is not sufficient soil for any green thing to exist, and over the larger part of the whole area, owing both to lack of soil and to lack of moisture, nothing but stunted sage bush can grow.

Through this weary waste, the Snake River winds its way, having worn for much of the distance one of the most remarkable cañons anywhere to be found in the world. Coming down from the Yellowstone Park and Teton Mountains, the Snake River enters these lava plains near Eagle Rock, and for about 150 miles flows not far below the general level of the country. Through this part of its course the water of the river is, to a considerable extent, available for irrigation, and several hundred thousand acres of land have been brought under cultivation by that means; the chief drawback being the high altitude (from 4,000 to 5,000 feet above the sea), which greatly limits the variety of crops.

Near the 37th meridian the river enters the famous cañon which occasioned such distress to the early emigrants and explorers. It was here, not far below Starr's or Rice's Ferry, that Astor's party, in 1811, lost their boats, and entered upon the unknown and almost unexampled perils that were before them. In a space of fifty miles the river falls no less than 1,400 feet, while the general level of the lava plain falls but 400 feet. The course of the river for this whole distance is through a narrow gorge, with precipitous walls of columnar basalt on either side, and during much of the way it is absolutely inaccessible. It is quite possible here for men to lie down upon the brink of the river and die from thirst, with abundance of water in the bottom of the cañon in full view.

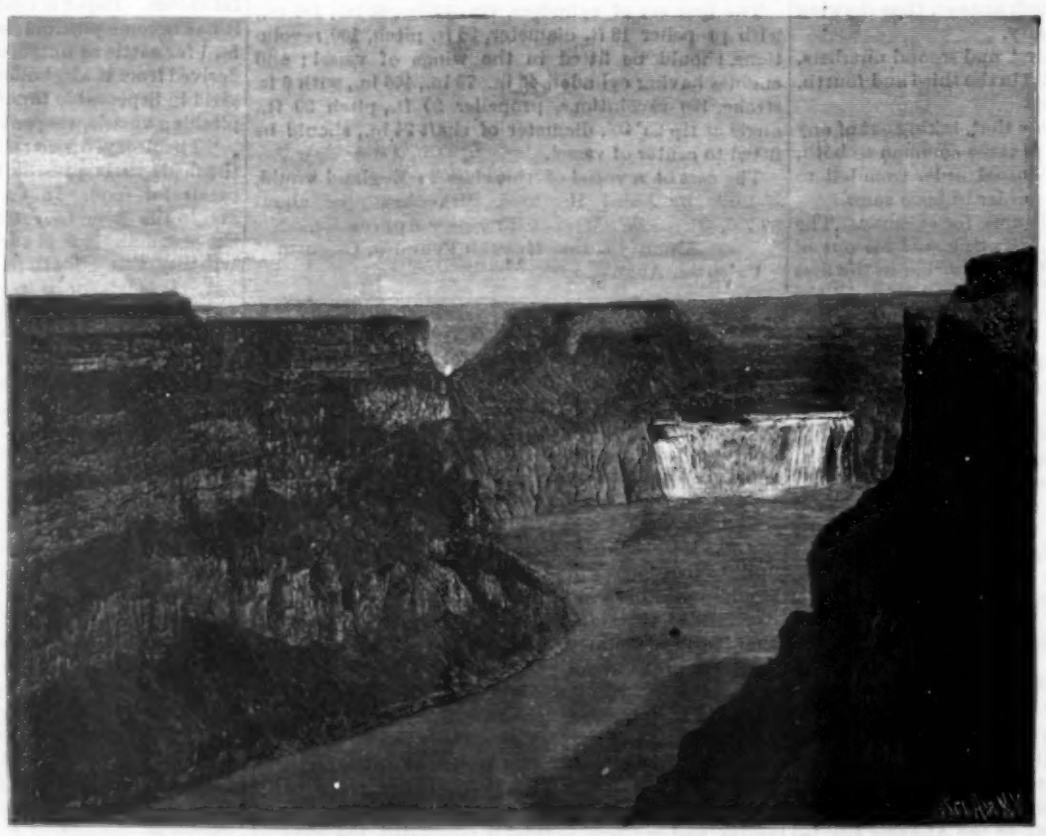
At Shoshone Falls the great river, after having flowed for nearly fifty miles in this deepening cañon, until its bed is already 700 feet below the level-topped lava on either side, makes another plunge of more than 200 feet, forming one of the most impressive cataracts in the world. Below the falls for many miles the river flows through a cañon 1,000 feet in depth and not much more than that in width, with walls so abrupt that at almost any point a stone can be thrown from the edge of the precipice into the flowing water.

Up to this point great schools of salmon from the Columbia River are able to press their way, and where the river is accessible it has been a famous gathering point for the Indians to lay in their annual store of fish. Salmon Falls, some thirty or forty miles below Shoshone Falls, are only from fifteen to twenty feet in height, and in the proper season of the year a ceaseless line of salmon may be seen endeavoring, with more or less success, to jump the falls and attain the more quiet water above.



THE THOUSAND SPRINGS, SNAKE RIVER CAÑON.

The view shows the north wall of Snake River cañon, near Salmon Falls. Height of wall, 380 ft. The "Thousand Springs" are seen coming out from the precipice 180 ft. below the top.



SHOSHONE FALLS AND CAÑON OF SNAKE RIVER.

Walls of cañon of basalt, 1,000 ft. high. Falls, 250 ft. high.

A point of chief interest in my investigations last summer was found about ten miles above Salmon Falls. Here the lava appears only upon the north side of the river, abutting upon the narrow valley in a precipice 380 feet in height. Out of the face of this precipice, through channels worn between lava beds of successive periods, there bursts a most remarkable series of springs. The line of their exit is 200 feet above the river, and 180 feet below the top of the precipice. The supply of water is enormous, and is said to be constant through the year. Mr. A. D. Foote, an eminent hydraulic engineer, told me that, according to his rough estimate, these springs furnished, in a space of three miles, no less than 4,000 cubic feet of water per second, and Mr. F. J. Mills, an equally competent authority, assured me that during the dry season these springs nearly doubled the flow of water in the Snake River at that point.

The origin of these streams becomes apparent upon a general study of the lava beds above. For 300 miles the lava is continuous upon the north side of the river, and throughout this distance the Snake River does not receive a single superficial tributary from the north. But upon going over to the farther edge of the lava, where it abuts against the foot hills of the extensive mountains beyond, we find that numerous rivers of considerable size come down from them, and disappear in the lava plain. Camas Creek, Beaver Creek, Medicine Lodge Creek, Birch Creek, Little Lost and Big Lost Rivers are some of the streams which thus disappear. Doubtless it is the waters from these streams, after wandering, much of it, for hundreds of miles in underground passages, which burst forth in such a remarkable manner from the face of the cliffs near Salmon Falls.

Hoping to utilize this water for irrigating purposes, Mr. Mills surveyed the region for the United States government, but found that the surface of the plain accessible below was higher than the exit of these springs. When, however, population shall press more closely upon the resources of nature in our country, we may be sure that all this water will be made available. To say nothing of the mechanical power that might be used for manufacturing purposes, a part of the water may some time be used to pump the other part up to the level of the surrounding plains, and thus transform a portion of them from dreary wastes to fruitful fields.

To those who may have read in the SCIENTIFIC AMERICAN for November 9, 1889, my account of the little clay image found at Nampa, Idaho, beneath thin lava deposits, at a depth in all of 320 feet below the surface, a single word concerning the situation there may be acceptable. Nampa I found to be not more than five miles from the extreme western edge of the great basaltic plains of the Snake River Valley, and the lava, which is hundreds of feet thick to the east, had there thinned out to a thickness of 15 feet, and was flowing over unconsolidated strata of clay and quicksand. Nothing appears, therefore, in the circumstances to throw any doubt over the genuineness of the discovery, and its date remains to be approximately ascertained by studying the erosion of the rivers which has

taken place in this part of the valley. I have not at present worked out the problem sufficiently to make such an estimate, but can only say in general that while geologically the strata are very recent, they are, as we reckon human history, very ancient, and closely correspond in their age to the human relics reported by Prof. Whitney and others in the gold-bearing gravels under the lava deposits of Table Mountain, in Calaveras and Tuolumne Counties, California. Evidently, therefore, the Scripture saying is here again fulfilled, that "the first shall be last, and the last shall be first." For the portion of the continent earliest occupied by man will only now in these late days be ready to be reoccupied when the great hydraulic schemes inaugurated for irrigating this region shall have been carried out and made realities.

THE WASHINGTON BRIDGE.

This beautiful structure, completed in December, 1888, at a cost of $3,851,684, and accepted from the contractors in March, 1889, appears to be still under the control of the bridge commissioners, not having been officially turned over to the city, although it has been for more than two years in public use. It connects Tenth Avenue at 181st Street, on the west side of the Harlem River, with Aqueduct Avenue on the east side of the river, the length of the bridge and approaches being 2,375 feet. It has two steel arches, each of 510 feet span, giving a clear height of 133 feet above the water, and its roadway is 80 feet wide between the parapets, 50 feet being a carriage-way, while there are two sidewalks, each 15 feet wide, protected by heavy balustrades of iron and bronze. The three main piers are 40 feet thick at the point from which the steel arches spring, and 98 feet long, and the abutments on each side are formed of three semicircular masonry arches, each of 60 feet span. The weight and thrust of the six steel ribs forming each arch are borne by large blocks of granite set normal to the thrust, and backed by granite blocks and concrete. Above this the piers are cellular, the main piers and abutments being crowned with a deep bracketed cornice with parapet.

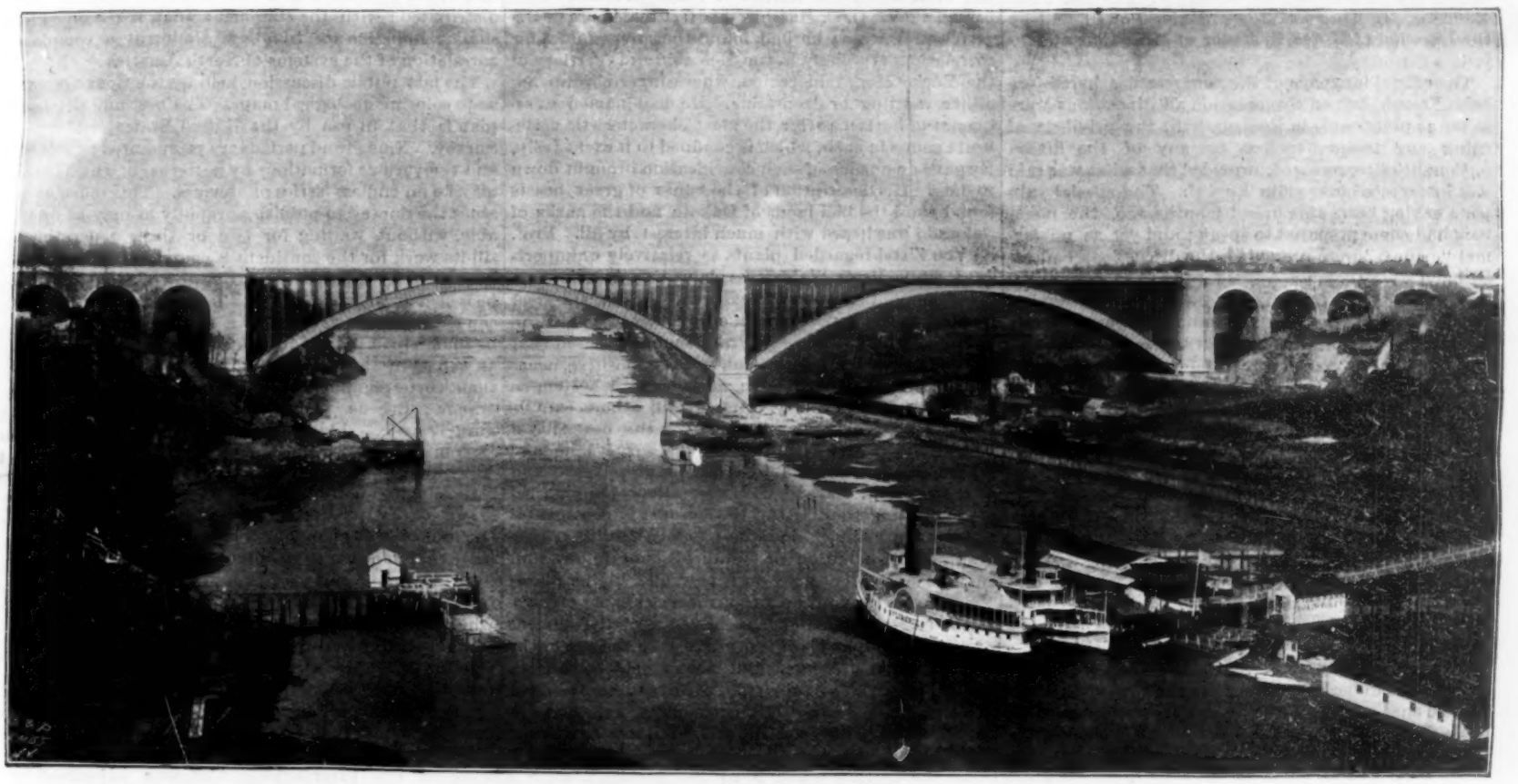
On the western side of the river, where the bluff rises abruptly from the water, no difficulty was experienced in getting a good rock foundation, but the central pier was built with the aid of a caisson, and it was necessary to go 40½ feet below mean high water before a suitable rock foundation was reached. The foundation of the eastern main pier was carried down 43 feet, and laid on a bed of concrete 6 feet thick. More than 40,000 cubic yards of dressed granite and gneiss were used in the bridge, costing $827,000, and there are 7,550,000 pounds of steel in the arch ribs and bracing, and nearly 6,000,000 pounds of iron in the posts, bracings, and floor, besides 1,234,000 pounds of cast and wrought iron in the cornice and balustrade, the iron and steel used costing a little over $900,000.

WE are informed that at Spikenard, Jackson County, Oregon, asbestos, of all grades and in large quantities, has recently been discovered, and active preparations for working the various fields are being made. The mines are near good roads, with plenty of timber and water power close at hand.

The Tennessee River Improvements.

In addition to the many rock reefs and other minor obstructions, the Tennessee River is divided into two sections, which were, until recently, entirely isolated from each other by the chain of reefs and rapids known as the Muscle Shoals (near Chattanooga). More than sixty years ago steps were taken to build a canal around this obstruction, and a canal was finally built, but it soon became useless from damages caused by heavy floods, and for want of funds to make repairs it had to be abandoned. Some eighteen years ago an appropriation was made for rebuilding the canal, and within the past year the work has been so far completed as to permit the passage of boats, though much work still remains to be done to give a satisfactory channel through this obstruction and to complete the removal of minor obstructions in other parts of the river.

Without going into details, it may be stated that the Muscle Shoals improvement consists of 16 miles of canal and 12 miles of open channel work. The canal is from 80 to 120 feet wide and has eleven substantial locks of cut stone, 300 by 60 feet in the chamber, and with lifts varying from 5 to 13 feet. The lock walls, placed end to end, would make a wall 18 feet high, 7 feet thick, and 2 miles long. Over 270,000 cubic yards of solid rock have been blasted from the bed of the river and canal trunk, more than a million cubic yards of earth excavated, and half a million cubic yards of embankment built. Two thousand two hundred and seventy-eight tons of iron were used in the construction of the lock gates and aqueduct, and two and a half miles of heavy stone dams have been built.—*W. R. King.*



THE WASHINGTON BRIDGE OVER THE HARLEM RIVER, AT 181ST STREET, NEW YORK CITY.

Poor Speed of the New British Fleet.

The London *Times* correspondent's letter from the fleet recently confirmed entirely our view of the failure of the new fleet to attain the speed for which it was designed. "Last night's speed," he writes, under date of July 31, "was rather more than thirteen knots, and though at that speed the Hero and Conqueror, and especially the former, were at times appreciably astern of station, they would have been perfectly able to keep station throughout a series of tactical evolutions conducted at a speed of twelve to thirteen knots. On the other hand, it seemed as if the torpedo gunboats, which are supposed to have a speed on paper of twenty-one knots with forced draught, could only maintain the speed of the squadron with considerable difficulty. The smoke they emitted gave signs of assiduous stoking, and as night fell, the Sheldrake in particular frequently exhibited a pendant of murky flame at her funnel. I noticed this morning that both her funnels were very much blacked with the heat." Yet none the less, instead of attaining the paper speed assigned to them, these torpedo gunboats could hardly sustain the far inferior speed of thirteen knots. The Sharpshooter, for instance, was estimated to attain twenty-one knots, and its machinery, planned for the purpose, cost more than double that of the machinery of the Redpole, a slow boat. Yet it hardly at all exceeded the speed of the Redpole, so that all the enormous extra cost of its machinery was, as far as speed was concerned, utterly wasted. There is something rotten in the execution of these torpedo gunboats. We believe that it consists in the nervous dread felt of the new boilers, and in the expensive expedients which are fruitlessly tried in the hope of making the old boilers more effective.—*Spectator.*

Use of Hyoscine.

In a paper in the *Journal of Mental Science* Dr. Lionel Weatherly has a very strong word to say in favor of hyoscine in certain conditions. There is little doubt that his warning against mistaking it for hyoscyamine is not unnecessary, and it is now high time that it should be recognized that in these two substances we have to deal with alkaloids of very different characters, from the point of view at least of the clinical physician. Dr. Weatherly believes strongly in the powers of hyoscine as a mental alterative. He has found it particularly useful in that form of mental disturbance which renders the patient violent and abusive, restless and domineering—a nuisance to every one who has anything to do with him. Under the administration of repeated small doses of hyoscine such a patient becomes a changed man. Violence and abusiveness give place to an amiable politeness, and instead of indulging himself in the free exercise of an extensive if somewhat shady vocabulary, the patient subsides into silence. Those are the cases in which Dr. Weatherly finds the drug most useful, and in which he believes it acts as a true mental alterative. It is also, he says, a useful drug in delirium tremens, and in other diseases in which tremor is a marked symptom, such as disseminated sclerosis, and it has the great advantage of being in most circumstances quite safe. It is not without reason that Dr. Weatherly enters a word of warning against its indiscriminate use as a sudden and powerful hypnotic; yet there would appear to be no doubt that it finds its greatest, and probably its most useful, application in the treatment of maniacal violence and noisiness, and that, at least in ordinary hospital work, it is a drug for emergencies.—*Lancet.*

Stimulation of Muscle by Light.

To the usual well known ways of stimulating muscles to contraction, viz., electrical, thermal, mechanical, and chemical, M. D'Arsonval has, says *Nature*, recently added that by means of light. He could not, indeed, get any contraction in a fresh frog muscle, when he suddenly threw bright light on it in a dark chamber; but having first in darkness stimulated a muscle with induction currents too weak to give a visible effect, and then suddenly illuminated the muscle with an arc light, the muscle showed slight tremulation. Not thinking this conclusive, however, M. D'Arsonval attached a muscle to the middle of a piece of skin stretched on a funnel, and connected the tube of the funnel by means of a piece of India rubber tube with the ear. The muscle being now subjected to intense intermittent light, he heard a tone corresponding to the period of illumination, and this ceased when the muscle was killed with heat. Arc light was used, which was concentrated by a lens and passed through an alum solution to stop the heat rays.

The International Congress of Geologists.

BY H. C. HOVEY.

Fifteen years ago, at a meeting of the American Association for the Advancement of Science, the idea was suggested by Dr. T. Sterry Hunt of a triennial gathering of representative geologists of all nations. The idea met with favor, and conventions of this kind have been already held at Paris, Boulogne, Berlin and London. The fifth meeting of the geological congress has just been held in Washington, D. C., from Aug. 26 to September 1, followed by interesting excursions to the Rocky Mountains and elsewhere, thus enabling the scientists to prolong their friendly intercourse and also to study together many of the most important features of American geology. The business proceedings were regulated by a council; but the greatest freedom of discussion was allowed in the public meetings. Each member wore a bronze medal, struck by the mint, bearing on one side a map of North America, and on the other the inscription over crossed hammers, "Mente et malleo." The brainy and brawny looks of these toilers amid the rocks proved that their thoughtful labors had found a certain reward.

Addresses of welcome were made by Prof. Joseph Le Conte, acting president, in the absence of Prof. Newberry, by Hon. G. G. Hubbard, Major Powell and Secretary Noble. Responses were made by Prof. T. McKinney Hughes, of Cambridge, England, and Prof. Albert Gaudry, of Paris. Evening receptions were tendered by the Geological Society of America, Prof. Emmons, Mr. Thomas Wilson, Major Powell, and by the Legation of Korea in honor of "His Chosun Majesty's Birthday."

The official language of the congress has heretofore been French, but on this occasion all discussions were as far as practicable in English, with the privilege of using any tongue spoken by any of the fifteen nationalities represented, provided that what was said was interpreted into plain English. The special subjects having been announced months ago, the members had come prepared to speak; and yet as no formal "papers" were presented, the discussions had an off-hand style that made them peculiarly attractive, even though often carried on in polyglot. After having sufficiently examined the maps, photographs, minerals and fossils on exhibition in the various rooms of the Columbian University, the congress repaired to the main lecture hall and began their work in good earnest.

The topic first discussed, and to which an entire day was devoted, was the "Genetic Classification of the Pleistocene Deposits." It is well known that the glacial drift is spread over the whole breadth of our continent and as far south as the Ohio River, consisting of sand, gravel and bowlders, either in view or underlying the soil; while naked ledges of rocks in this vast region are often marked by furrows and striæ. The accepted theory is that all this was caused by one or more immense glaciers, and the period is known as Post-tertiary, Quaternary, or Pleistocene—the last name being preferred by the Congress.

Prof. Chamberlain, in opening the discussion, admitted that our ultimate goal must be chronological classification, but asserted that nothing stood more in the way of the progress of American geologists than their presumptive haste to fix time limits for which we have not yet sufficient data. There may have been one, two, three, or four distinct glacial periods. We do not know. Meanwhile our primary work is that of genetic classification. He laid an elaborate scheme of this kind before the Congress, illustrating it by a large map of North America, on which the known area of the Ice Age was painted white, extending from the Arctic zone down to the latitude of 38° or 40°, with the exception of a region in Wisconsin which had somehow escaped from the general invasion. His scheme recognized six general classes with many subdivisions, but including only such formations as are directly or indirectly due to glacial action. Dr. Wahnschaffe, from the University of Berlin, strongly advocated a chronological classification, in which he was supported by Baron De Geer, of Sweden, and Prof. Gaudry, of Paris, who maintained that in Europe there were two distinct horizons distinguished by different faunas. Professors Credner, of Leipsic; Diener, of Vienna; Holst, of Sweden; and Hughes, of England, contended that the organic remains, the moraines and pitted plains, the kames and osars, merely indicated the advance and retreat of one continuous ice sheet. Prof. Shaler remarked that there might be an interweaving of glacial deposits with organic deposits occurring near the ice sheet. Prof. Gilbert, of the United States Survey, observed that in Alaska there are existing glaciers covered with forests in which bears and other animals live. Another speaker called attention to the fact that in the Austrian Alps, moraines no more than twenty years old are covered with pasture, and that in the Caucasus the rhododendron grows to the very edge of the ice. Prof. Cope had found in the "Equus beds" a tropical interglacial fauna succeeded by a boreal fauna. Dr. Christie and Dr. Cadell described glacial phenomena observed in Scotland. Prof. Pavlow, of Moscow, spoke for Russia, but was of the opinion that we needed a more clear definition of Pleistocene before a satisfactory classification could be secured. Mr. W. J. McGee, of United States Geological Survey, proposed a scheme that was favorably received, which, while genetic, like Chamberlain's, was broader, including aqueous, eolic, and volcanic contemporaneous phenomena as well as those that were glacial or aqueo-glacial.

Two days were next devoted to discussing the "Correlation of Geological Formations." Prof. Gilbert had the honor of opening and closing the discussion. His proposed scheme included six physical and four biotic methods of correlation. *Physical:* 1. Visible continuity. 2. Lithologic similarity. 3. Similarity of lithological sequence. 4. Breaks, or unconformities. 5. Simultaneous relations to physical events. 6. Comparison of changes due to continuous geologic processes. *Biotic:* 7. Matching by species. 8. Matching by genera and families. 9. Divergence from status of fixed dates. 10. Relation to climatic episodes. Biotic methods are limited by the facts of geographic distribution; and correlations at short range are better than those at long range. The great body of correlation is based on similarity of sequence. Examples of (4) are found in our Triassic areas; of (5) in formations in Utah related to certain lake beds, also in alluvial, littoral and subaqueous deposits. In biotic methods insects were the most useless and marine mollusks the most valuable. Fucoids have too wide a range in time and the vertebrates too narrow a range in space. This brought Prof. O. C. Marsh to his feet in defense of the vertebrates, which he had found the surest guides for correlation, especially in the Mesozoic and Tertiary of the Rocky Mountain region, where invertebrates are either wanting or lacustrine. He had named a sequence of horizons after the most characteristic vertebrate genus in each, which is confined to it exclusively. He gave an outline of such classification brought down to date. His description of the bones of great beasts found amid the bad lands of Dakota and the parks of Colorado was heard with much interest by all. Prof. K. Von Zittel regarded plants as relatively unimportant; while Prof. Walcott explained their value, especially amid the coal measures. Baron De Geer insisted on the importance of a numerical comparison between different species. Prof. Hughes declared that all kinds of evidence are useful, whether positive, negative or circumstantial. We must have a system so varied that if ordinary criteria fail, others can be employed. Major Powell spoke of the necessity of specialization, and said that in his surveys he had gained excellent results by a union of physical and biotic methods. Mr. W. J. McGee advocated physical methods altogether. After the episodes of continental growth are mapped, and their fossils studied, a geographical distribution of organisms may follow that shall place paleontology on a new and higher plane. Prof. Lester F. Ward held that the great types of vegetation mark geologic epochs. Even a small fragment of a carboniferous plant is decisive as to the age of the rock in which it occurs. But more ample material is needed in order to fix the relative age of deposits in the same geologic series. Geologists have expected too much of the paleobotanists, and the latter have erred by trying to meet their demands. Prof. Claypole said that the marine fauna is to the geologist what a primary triangulation is for the geodesist, marking out the main divisions for subsequent subdivision by the aid of plants and vertebrates.

Prof. C. D. Walcott spoke on the correlation of the Cambrian rocks by both physical and biotic data, on the Atlantic coast, the Rocky Mountain areas and the interior continental plain. He eulogized the pioneers of the New York Survey, whose system was essentially in use to-day.

The venerable Prof. James Hall, who undertook the survey of New York in 1836, and who fifty years ago undertook to correlate the strata west of the Mississippi, described the difficulties and results of labors which were arduous under the circumstances. He urged the importance of both physical and faunal criteria.

Prof. Williams emphasized the fact that species may vary with environment. Near-shore fauna may differ from deep-sea fauna of the same age. Outside the centers of abundance varieties may appear that are not typical, though often called so.

Dr. F. Frech, of Halle, noted the identity of certain faunas of America and Europe, *e. g.*, of the Niagara and the Wenlock shales; of the Tully limestones and the Naples beds; of the carboniferous in Iowa, Spain and middle Germany. But after all many genera in one country are wanting in the other, although the rocks may have been formed under like physical conditions. Dr. Barrios, of Lille, admitted that European geologists encounter many of the same difficulties met by Americans, and thought it impossible to compare in detail the rocks of the two countries, although some individual zones might be correlated. Autopsy is the only basis. Geologists must see the beds before a comparison can be instituted. Otherwise there was no general basis.

Prof. C. R. Van Hise elaborately described the distribution, character and succession of the pre-Cambrian rocks. We have been retarded by the idea that lithological character is a test of geologic age. Silurian, Devonian, and even Carboniferous rocks have been known to become as highly crystalline as those that are more ancient. We shall have to abandon such terms as Huronian and Laurentian, and in the absence of any well known pre-Cambrian fauna, include all the series under the general term Algonkian, as is now done by the U. S. Geological Survey. Prof. Pumpelly confirmed this by his observations in the Green Mountain region, citing a formation that varied from quartzite to gneiss, to conglomerate, and to mica schist at different localities.

Prof. Cope said that there is a marked difference in the present faunas of continents, and that we need to study vertical as well as horizontal ranges. He inclined to think that certain vertebrate forms did not spread from a single center of origin, but from different places; adding that life in its progress had its own laws and differed from minerals and rocks.

Prof. Gilbert, in concluding this very interesting and extended discussion, was of the opinion that many methods of correlation must be used, and expressed his gratification that his scheme of general classification had served the Congress so well, although subjected to modifications.

In connection with the foregoing discussion an official bulletin by Prof. H. S. Williams, on the classification of the Devonian and Carboniferous systems, was distributed; with the statement that seven or eight similar bulletins are to follow, aiming at a complete correlation of the systems of North America.

The last public discussion held by the Congress was as to coloring geological maps. The best and simplest plan is that in use by the United States Geological Survey. Nine grand periods are represented by colors, and the various formations by patterns, of which there may be an endless series of devices. This scheme enables the Survey to publish as rapidly as may be desirable, without waiting for two or three generations, till its work for the continent is complete. There will be 7,000 or 8,000 maps in all, but any one of them can be issued at any time, so that the interests of the people can continually be served by a method so simple as to be understood by any intelligent farmer or mechanic, as well as by the scientist. The order of periods and their corresponding colors are as follows: Neocene, orange; Eocene, yellow; Cretaceous, yellow-green; Jura-Triassic, blue-green; Carboniferous, blue; Devonian, violet; Silurian, purple; Cambrian, pink; Algonkian, red.

In reply to an inquiry as to why black was not used for coal, Major Powell replied that it had been thought of, but abandoned, because there was really more coal in either the Cretaceous or the Eocene than in the Carboniferous period, and therefore such marking would mislead. Many views were advanced, and while general admiration was expressed for the American scheme, it was evident that the time was not yet ripe for its adoption by foreign countries. Indeed, it might be said in summing up the entire results of the Congress that progress was made by a comparison of opinions rather than by the vote of the majority.

After the customary resolutions and farewell speeches the International Congress adjourned to meet in 1894 in Switzerland. A invitation from the Emperor of Russia was accepted to meet in 1897 in the city of St. Petersburg.

A Locomotive Explosion.

An esteemed correspondent writes us that the boiler of one of the large freight engines of the Norfolk and Western Railroad exploded at 5 o'clock A M., Aug. 27, at Tazewell Station, Va., killing the engineer and seriously injuring the fireman and breaking the arm of Engineer Philips, who was standing some 150 yards distant. The explosion was caused by injecting water into the empty boiler. It seems that the train engineer, Carpenter, was advised to take water at Pounding Mill tank, but relying upon his own judgment he concluded to run to Tazewell Station, some 15 miles distant, but just before arriving at the tank the engine refused to pull the loaded train, when the engine was uncoupled and run down to the tank, some half mile distant. The boiler being empty and red hot, no sooner was the pump put to work than there was a terrific explosion. Both ends of the boiler were blown out to some distance, followed by a great spurt of steam, which scalded the engineer and completely demolished the cab. The door of the cab was blown some distance, striking Mr. Philips, who was washing his face and hands at a pump some 150 yards distance, and breaking his arm above and below the elbow. The fireman was burned and otherwise slightly injured.

Artificial Marble.

H. Bruck says this composition ("marmorit") contains 2 parts of magnesia, 2 parts of lime and quicklime, 1 part of carbonic acid, ¼ part of silicic acid, ⅛ part of argillaceous earth, and 1 part of magnesium chloride.

Military Bicycling.

The Connecticut National Guard has made an experiment in military bicycling. The men rode safety machines and carried Colt's lightning magazine 44 caliber carbines and Colt's regulation army revolver. When mounted each man carries his carbine slung across his back by means of a strap. The carbine has a capacity of 12 shots and the revolver of 6 shots, giving to the nine wheelmen a total of 162 shots to be fired without pausing to reload. The weight of the carbine is five pounds. The manual used by these wheelmen was compiled by Lieutenant Giddings from United States infantry and English cycle tactics. The Hartford *Post* thus describes a sham fight between the wheelmen and a detachment of infantry and a squad of cavalry:

The wheelmen appeared at the battery in a column of twos. Then they came to company front and advanced down the parade ground toward headquarters. About half way they encountered the infantry, who opened fire upon them. Instantly the command to halt was given, the wheels were dropped to the ground, and the line, deploying as skirmishers, fired several volleys, advancing about 20 feet each time and lying flat on the ground. The infantry retired and the recall to the wheels was sounded. When the wheels were reached the cavalry appeared, advancing at a full gallop to support the infantry. The wheelmen formed a "zebra" by inverting their machines and, kneeling or lying behind the whirling wheels, received them with their repeating rifles and revolvers. The cavalry used revolvers, and in a few moments, when the wheelmen had exhausted their ammunition, the order was given to retreat at double quick time. In a moment they were all mounted and "scooting" down the parade ground. They could not keep pace with the horsemen, however, who galloped in among the flying wheelmen and drove them to their tents.

The wheelmen were also tested as messengers, but the flag signaling with which the wheel messenger competed seems to have been very slow. Colonel Doherty, of the Second Connecticut Regiment, was supposed to be attacked on his flank when two miles away from camp. He sent a message of some ten or fifteen words to headquarters by means of the regular flag signal service, asking that a machine gun be sent to his assistance at once. At the same time he gave the message to one of Lieutenant Giddings' wheelmen for delivery. For the first half mile the message was carried for the regular service by a horseman to a house from whose roof the first flag began to wig-wag. The bicyclist reached his destination and delivered his dispatch in 10 minutes, while the same message did not get in until 40 minutes later through the ordinary signaling by flags. In fact, the gun had reached its position and was already firing in support of Colonel Doherty, two miles away, when the message asking for it reached headquarters according to the usual method.

Remarkable Scene at a Revival Meeting.

A few weeks ago the Free Methodists began a series of revival meetings in Sydenham, Ontario, Canada, so says the New York *World*, and made many converts. As the number of converts increased so did the excitement, and the meetings, which were held in the town hall, grew so noisy that complaint was made to the authorities and the revivalists adjourned to a large vacant lot in the edge of town. Here they were addressed by J. F. Frasier, a revivalist, who sailed into the prevailing mode of female dress, and said women are born beautiful and die misshapen because of the wearing of corsets. Frasier is an earnest and powerful speaker and his words created great excitement among the women present.

"Throw off the accursed invention!" he cried, "throw it off and go to God as you left him! Burn them rather than burn yourselves in everlasting fire!"

This suggestion struck a responsive chord, and he had hardly ceased speaking when an enthusiast piled up material for a bonfire and applied a match. It was a weird scene, the dusky evening, the crowd of religious enthusiasts, quivering with excitement, surrounding a fire which shot up long tongues of flame.

"Throw off the garment!" shouted the revivalist.

"Burn them!" hysterically cried a feminine voice in the crowd, and pushing and panting a young woman of twenty-five forced her way to the center near the bonfire. She was tugging at her dress. There was a sudden gleam of white shoulders in the glare of the fire light and she flung her corset into the flames, saying she would die as God made her and not as she had made herself.

Her example was contagious, and in less than half an hour not a woman in the crowd wore a corset, and nothing remained in the blaze but a mass of grotesquely twisted corset steels, amid which the flames playfully flickered. The excitement was so great and the nervous strain so tense that several women grew faint, but they had burned their corsets and were happy.

The Free Methodists consider the revival a great success, and talk of carrying the war into the States.

THE VANISHING LADY.

All that is necessary for the performance of this trick is a chair, a newspaper, and a shawl made of very light silk. The prestidigitator takes the newspaper, unfolds it and spreads it on the floor under the chair, so as to separate the latter entirely from the floor. A screen is placed a short distance back of the chair. After this has been done a lady enters dressed in any style of costume, but generally in a Roman or Greek dress, and takes her seat in the chair. She is then covered by the shawl which we mentioned above, as shown in Fig. 1, until she is entirely enveloped, even to

THE VANISHING LADY IS COVERED WITH A SILK SHAWL.

her knees and feet. The sleight of hand performer then withdraws and calls out solemnly "one, two," and at the word "three" the shawl and the lady disappear as if by magic, leaving only the newspaper and the chair, Fig. 2. The effect is very startling, and until the trick is explained it is almost impossible to believe one's eyes.

Since this trick was first introduced it has been more or less perfected or modified in its form, but the following description states the methods generally employed in performing the trick.

If the newspaper is carefully examined, it will be found to be made of India rubber and to contain a large rent at about the center. The paper is placed directly over a trap door and the chair is placed upon it and in such a position that the trap will open directly under the feet of the lady as she sits in the chair. While the lady is being enveloped in the shawl an invisible frame is raised which sustains the shawl, and gives it the form of the figure. When the shawl is finally in place, the lady tilts the seat of the chair and passes between the legs, through the paper, into the trap

THE SHAWL AND LADY HAVE VANISHED.

opening which has been prepared for that purpose, and slides under the floor. At the same instant the chair tilts back to its original position, and at the word "three" the shawl is suddenly drawn behind the screen by means of an invisible thread. It appears as if it were the woman and the shawl which both suddenly disappear, as the movement of the shawl cannot be followed by the eyes of the spectator. The frame disappears at the same time, leaving nothing behind but the chair and the paper. The rubber newspaper returns to its natural form and leaves no trace of the opening beneath.

We are indebted to *La Nature* for the article and the engravings, as well as for the article on a somewhat similar trick which was described in the SCIENTIFIC AMERICAN of April 25, 1891. In this latter article the lady was placed in a palanquin carried on the backs of four men, and at a certain part of the performance the curtains were dropped and in an instant were raised again, when it was discovered that the lady had vanished.

Molasses as Fuel.

Our Louisiana crop of molasses is about 450,000 barrels, and will be a constantly increasing quantity; a large part of it is of superior quality which finds a ready market, and the lower grades are constantly increasing; for these lower grades there is now scarcely any market, and their value has fallen so low that the question of the fuel value of such goods has arisen; the lower grades will increase in quantity comparatively, as the more thorough the manufacture of sugar is, the lower the grade of the resulting molasses.

The analysis of low grade Louisiana molasses indicates 32 per cent sucrose, 25 per cent glucose, 23 per cent other solids not sugar, and 20 per cent water. We thus have an article containing but 20 per cent of water, and the rest of it largely carbon, and it would seem, theoretically at least, to have a comparatively good fuel value. Its present market value leaves its value on the plantations at about 2 cents per gallon, or $3.33 per ton, which price per ton is about the present value of coal. If it could be demonstrated that such molasses has a fuel value equal to or about to coal, pound for pound, it would quickly solve the problem which is now exciting much attention in Louisiana.

The distillation of molasses into alcohol may be a more profitable method for its disposition, but as no experiments have been made here in that direction for many years, we are comparatively in the dark there also. If our correspondent would make some tests with molasses and be prepared to give guarantees that his apparatus [device for burning liquid fuels] would successfully burn it, and with adequate economic results, he would certainly have no trouble in introducing it into Louisiana.—*La. Planter.*

American Iron for Canada.

The *Monetary Times*, of Toronto, says: Our market reports indicate that the iron and steel trade of Canada with Great Britain is undergoing a marked change. Ontario is now importing pig iron largely from the United States, where a year or two ago she bought exclusively from Great Britain. Bar iron, too, she is beginning to buy from the Americans. Steel boiler plate tubes she still buys from the old country, but the Londonderry Works, in Nova Scotia, manage to keep out the cheap steel. It is worth while to notice that the Canadian duty on bar iron is equal to $14.56 on a gross ton of bar which costs £5 10s.; also that the duty on common steel is 60 cents per 100 lb. There are hardly any stocks of pig held in Montreal or Toronto now. A large proportion of the pig iron sold in Canada nowadays is American; this is especially true of Ontario, which is the nearest province to that market. Quebec still buys from Great Britain. The American "drummers" from New York and Philadelphia and a firm representing furnaces in Buffalo, Cincinnati, and Chicago, are canvassing Ontario cities every week. They sell pig iron in Toronto which comes all the way from Alabama, and which is probably the cheapest in the market.

The Eastern Boundary of Alaska.

A government coast and geodetic survey party, which has been two years in Alaska, has recently reported that the Yukon gold fields, which have thus far attracted the most attention, are in Canadian and not in United States territory, as had hitherto been supposed. The boundary line is the 141st meridian of west longitude, but its location had not before been marked by the surveys, and will now have to be more exactly fixed by a joint commission of the two governments. There were several hundred miners in the district, and the upper Yukon territory lying just along the border line is said to be attracting large numbers of seekers for the precious metals.

The Densities of Oxygen, Hydrogen, and Nitrogen.

The densities of the three gases are within less than 1-10,000 part.

Hydrogen	0·0695
Oxygen	1·1050
Nitrogen	0·9720

From these values the mean centesimal proportion may be deduced as 23·235 by weight and 21·026 by volume. According to these experiments, the atomic weight of nitrogen would be 13·99, and that of oxygen 15·905.—*A. Leduc.*

RECENTLY PATENTED INVENTIONS.

Railway Appliances.

CAR COUPLING.—Albert E. Jones and Thomas F. Fagan, Duquesne, Pa. This invention relates to arrow head and jaw couplers, of simple construction and with few parts, designed to be safe and easily operated. The coupling jaws are centrally pivoted in a box-like receptacle, their heads beveled at their forward ends and springs bearing on the outer faces of the heads, while a spring bears on the inner faces of the rear portions of the jaws, links being connected with the rear ends of the jaws and a lever connected with the links. The arrangement is such that the lever will rest either to one side of the car or vertically, and to uncouple the lever is simply reversed, drawing the rear ends of the jaws together, separating the jaw heads and releasing the arrow head.

CAB WINDOW DUST GUARD. — Frank C. Bond, Port Jervis, N. Y. A protecting window for locomotive cabs, one which will not become frosted or clouded from the heat in the cab when it is cold outside, and will protect the engineer and fireman from cinders and the weather when looking forward, is provided for by this patent. The invention consists in arranging forward and rear windows with an arm rest at the side of the latter, the guard window being outside of and independent of these windows and hinged at one edge to the cab side; it opens at a right angle, and when open bears against the arm rest, while securing devices are provided by which it may be held in open and closed positions.

Mechanical Appliances.

SAWMILL DOG. — William H. Mitchell, Smith's Cross Roads, Ky. A sleeve sliding on a post has a projecting bracket holding an adjustable lower dog, while there is an adjusting bar sliding in the sleeve bracket and a socket on the bar to retain an upper dog, an adjusting lever being pivoted on the bracket and connected by a link with the adjusting bar. The device is designed to efficiently engage the upper and lower surfaces of round or quartered logs, and permits of the log or quarter being moved downward over the point of the head block and retained in its proper relation to the saw, while it may also be used as an overdog.

PRINTING PRESS FEED.—Mark Jacobs, New York City. This is a feed attachment for use in connection with the printing of tapes or ribbons, the spacing of the printed matter on the ribbon being automatically performed. It is secured to the platen, and consists of a shaft having a friction wheel and a drum, a spring-pressed shaft above the drum and adjustable friction wheels on the shaft, while a stationary segment with a friction surface engages the driving friction wheel and a pawl or detent limits the movement of the drum to one direction. When the device has been once set, the printing may be carried on continuously and the spacing between each impression will be evenly accomplished.

TROWEL HANDLE.—Richard J. Cooper, Duluth, Minn. This handle has a longitudinal recess in one end of which a measuring rule is hinged, adapted to fold into the recess, its back being of the shape of the rest of the handle. The device is designed to be a great convenience to and facilitate the work of the bricklayer, especially where projecting courses or panel work occur, enabling him to take the necessary measures with his towel as he holds it in his hand in the usual way.

YARN WINDER. — John D. Whyte, Manchester, England. This is a machine for winding yarn into cop form on bare spiddles, without pirns, spools, tubes or cops. The invention consists of a cop-building device comprising a thread guide to which a swinging motion is given by a revolving cam wheel, a nut traveling on a revolving screw rod carrying the cam wheel and thread guide pivot.

Agricultural.

CORN CRIB. — John Z. Benson, Lawn Hill, Iowa. This invention relates to doors for cribs and granaries, and is also adapted for use on vehicles. In the sides of the door frame are inclined grooves open from end to end, in which the grain cannot lodge, slides having shoulders to limit this inward movement fitting in the grooves. By this invention the door may be adjusted to afford such degree of ventilation as may be required, and the grain may be easily removed in small quantities if desired.

Miscellaneous.

GAME BOARD. — William G. Bullen, Milwaukee, Wis. This invention provides for a game to be played in imitation of a naval battle, the board having raised partitions at each end to represent fortified harbors in which the ships of each side are located, while centrally on the board are batteries and holes with game pockets marked "sunk." The ships are formed of rings of different colors to represent two contestants, there being also other distinctions for ordinary ships and flag ships. The ships or rings are moved about the board by blowing upon them through tapering tubes, the object of each player being to propel his ships so that they will pass the holes and batteries and enter the fortified harbor of his opponent. The ships of an opponent are sunk by propelling them into the game pockets, the game being counted by allowing a certain number of points for the different degrees of success.

MOLE TRAP.—George Ricardo, Hackensack, N. J. Combined with a main supporting frame is a vertically movable frame carrying the impaling rods, in connection with a trigger mechanism, while a spiral spring exterior to both frames is removably connected to them at its ends to exert a downward pull on the impaling frame when the trigger is released. The construction is very strong and simple, and the trap is readily placed in position and set so that the animal will have no chance to escape.

STEM-WINDING WATCH.—Raymond A. Lucas and Casper F. Phelps, Kohala, Hawaii. This is an attachment by which the winding gear will be disengaged when the spring is wound. Attached to the winding wheel is a bevel wheel engaged by a pinion on a threaded spindle, an internally threaded pinion on the spindle engaging a wide-faced pinion journaled in a mortise in the front plate of the movement, while a bevel wheel secured to the spring barrel engages a pinion on one end of an arbor whose opposite end has a bevel wheel engaging the wide-faced pinion. With this improvement there is no strain from overwinding, whether the watch be wound when only partially or when fully run down.

ANNUNCIATOR.—William C. Dillman, Brooklyn, N. Y. Speaking tubes being usually arranged in a building to center at a common point, this invention provides an annunciator to be operated from the upper end of a tube to clearly indicate which tube is to be used. A swinging leaf is supported beneath the mouth of each tube, to normally close it, the leaf being connected with one pole of a battery, while a contact bar is arranged in its rear beneath which swings a bent arm secured to the leaf, there being pivoted to the lower end of the bent arm a contact block to strike the contact bar, and an electric bell being included in the circuit. The mechanism may be operated by simply blowing in the tube at its upper end, or electrical means may be employed for depressing each leaf.

VENDING MACHINE. — David E. Durie and Alexander Begg, Seattle, Washington. Two patents have been granted these inventors on machines adapted to deliver newspapers or other publications by mechanism operated by coins dropped in a slot of the machine, the papers to be delivered on the insertion of a single coin or a number of coins, as may be most conveniently used for papers sold at different prices. In one of the machines, the paper called for by setting the mechanism in operation by the deposit of coin is projected by one edge through an opening in the case, when the purchaser takes hold of the paper and pulls it out. In the other machine a door is opened and the paper is delivered upon a tray, the door closing until the next time the mechanism is operated. The main case is designed to rest on the ground or floor, and be suited for use in various public places.

STAMP OR LABEL AFFIXER.—William B. Shafer, Somerset, Pa. This is a neat and inexpensive device affording means of moistening an envelope or other surface, and with a receptacle for stamps or labels, which may be affixed by the manipulation of the device, those not used being kept back in a separate and cleanly condition. The body of the instrument has transverse grooves and flanges at its lower end, with a stamp box open at both ends, the stamps being supported by flanges, in connection with a moistening device, the lowermost stamp being affixed by pressing down the body. The device may be utilized to facilitate the sealing of large numbers of envelopes, which can be effected with it without using the fingers therefor.

HYDRANT. — Penton A. Hardwick, Colorado City, Col. A simple and durable form of hydrant is provided by this invention, which may be set to discharge the water in the discharge pipe above the water main to prevent freezing in cold weather, or may be set for use in summer to permit the water to remain in the discharge pipe after disconnecting the latter from the water main. In connection with the head connected with the water main is a waste port leading to a sink hole or sewer connection, a half turn of the main valve ping opening communication with this port, whereby water remaining in the vertical portion of the discharge pipe may flow out.

BARREL STAND.—James J. Van Kersen, Kalamazoo, Mich. This is an attachment for barrels containing crackers or similar goods, for supporting the barrel in an inverted position and delivering the goods a part at a time as may be desired, in such a way as to be conveniently handled by the salesman. It consists of a box having lids on opposite sides and an opening in its top to receive the end of a barrel, there being cross bars below the opening to support the barrel, a partition projecting from the bottom of the box and a cover resting on the partition and against either of the cross bars, according as the crackers are to be discharged to one side or the other.

DUMPING WAGON. — Raymond A. Lucas and John T. Murray, Kohala, Hawaii. The driver can easily dump the contents of this wagon without leaving his seat, while the construction is strong and simple. A transverse shaft having gear wheels is mounted in the wagon bed, on which slides a body having racks engaging the gear wheels, a longitudinal shaft on the bed having one end geared to the transverse shaft, while a vertical crank shaft, extending to within convenient reach of the driver, is geared to the longitudinal shaft.

VAGINAL SYRINGE. — Loren E. Hendrickson, Paulding, Ohio. This invention provides an attachment applicable to old and new syringes, for dilating the walls of the vagina after the syringe has been inserted, to insure more thorough washing and cleansing.

HAIR CLIPPER.—Walter S. Bonham, St. Paul, Minn. This is a clipper with graded cutters located at opposite ends, and with a reversible handle, whereby a No. 1 and a No. 0 clipper are combined in a single implement; the handle may also be conveniently attached to or detached from the implement. The bottom plate has guard teeth or fingers of different thicknesses at opposite ends, over which are two independent cutters pressed by springs in opposite directions, one member of the handle being fixed and the other movable, the movable member having a finger to engage with either of the cutters and move it against the action of its spring.

LEVER CARPET FASTENER. — Benjamin Irvine, Beef Slough, Wis. This invention provides a simple form of lever carpet tack, designed to be pivoted in recesses in the floor near the wall, the tacks taking the place of the ordinary carpet tacks, and intended to be used in such a way as to facilitate the laying or taking up of a carpet almost entirely without the use of a hammer.

KEROSENE BURNER. — Alphonse M. P. Hervy, Aix-sur-Vienne, France. This burner is designed to insure complete combustion and permit of easily increasing or diminishing the flame without causing smell and smoke. It has an inner part, secured to the fount of the lamp, and an outer part held movably on the inner part to regulate the flame. The device has no wheels or similar mechanism to raise and lower the wick, which is closed to all exterior openings to avoid leakage of the fuel. The several parts can be conveniently removed for the purpose of cleaning, and the lamp can be refilled without removal of the parts.

NURSING BOTTLE HOLDER. — Peter Zimmerman, Jr., New York City. This is a device adapted to be held in position by means of a clamp attached to a support adjacent to where an infant is lying or sitting, and has a holder formed of loops of spring metal into which a bottle may be easily thrust and securely held, the loops adjusting themselves to different sizes of bottles. The device is readily adjustable to bring the bottle into convenient position, where it will be so held that it cannot be easily broken.

SAFETY VALVE.—Frederick W. Fisher, Walton, Liverpool, England. This valve is especially applicable to kitchen boilers which have a continuous circulation, and is also suitable for other boilers supplied by water under pressure. It has a case with an inlet on one side, above which is an escape port, and an outlet in the lower end, a main weight being held to slide in the case and a supplemental sliding weight arranged above the main weight, valves secured to the lower end of the main weight successively closing the inlet and opening the escape port. This valve may also be arranged to operate as a reducing valve.

INSECTICIDE.—Pietro Leonardi, Pietro Zen, and Giuseppe Sardi, Venice, Italy. This is an article which, while destructive to insects, is harmless to human beings or to textile fabrics. It is formed, after a manner described, of chrysanthemum flowers, liquid ammonia, and other ingredients, in certain proportions. The sprinkling of the liquid in places infested by insects effectually disperses and destroys them, while improving the air of the room in which it is used.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(3367) L. M. T. says: Would you kindly inform a constant reader how to successfully kiln dry oak lumber and not have it warp? We use 12 feet even length best quality Wisconsin red oak. In piling we have six sticks even thickness 2 feet apart, foundations of piles perfectly level, but the lumber is not straight. With exhaust in day we have 130 degrees, live steam at night 160 to 180 degrees of heat. Sometimes in the middle of drying we allow the kiln to cool down entirely, for instance, stopping Saturday night, and not starting it again till Monday morning. Does that affect it? Is an even temperature necessary? What is the right temperature for drying red oak when hot air is not used? How is lumber dried with hot air? What degree of heat and what size of blower? How can I figure the pressure of force of any sized blower? A. Try turning steam into the drying room at the same time it is turned upon the coils. Keep the room moist in this way until the lumber gets heated to 130° or 150°. Then shut off steam from the room and continue the heat with very little ventilation. This will dry the lumber evenly and make it less liable to warp. It is better to have an even heat, and the drying should be finished within the week. It is better for drying oak to heat to 200° if possible. This you can do with live steam by closing drying room nearly tight during the last of the process. Ventilating blowers give about 2 ounces pressure per square inch. The pressure depends upon the speed. Address Buffalo Forge Company, Buffalo, N. Y., for their blower circular, which gives size, velocity, and pressure, and also in regard to forced hot air drying.

(3368) A. G. G. asks (1) for the sizes of wire and the amount necessary for the primary and secondary parts of an induction coil made three times larger than the drawings of the one described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 160, of January 25, 1879, and the number of feet of tin foil required for the same. Would double cotton-covered copper wire do in place of naked wire? A. Use wire of the same size given in the article referred to, and double the size of the condenser. Double covered copper wire will answer. 2. What is the voltage and amperage of the hand power dynamo described in SUPPLEMENT, No. 161, of February 1, 1879? A. The machine yields a current of 4 or 5 amperes with an E.M.F. of 12 volts. 3. What is meant by alternate polarity in the field magnets of alternating dynamos? A. It means that the north and south poles of the field magnet are arranged in alternation. 4. Is the alternating principle patented? A. No.

(3369) W. A. writes: I send a sample of solder I purchased from a street corner man. It will stick to tin without a soldering iron or acid simply by holding a candle under the tin till it becomes heated. Will you say what it is made from? A. The sample of solder is nothing but common soft solder made of equal parts of tin and lead. You should apply a flux of resin or of zinc chloride before touching the solder to the surface, and the surface must be clean. The zinc

chloride soldering fluid is made by dissolving the zinc in muriatic acid to saturation, and diluting the solution with an equal quantity of water.

(3370) S. E. W. asks if the current will decompose the ferrocyanide of potassium on the telegraph paper after it has dried. Have you any books on printing telegraph machines? A. Dry chemical paper is not affected by the current. You will have to add something to your ferrocyanide solution to keep the paper moist. Carbonate of ammonium is a suitable substance for this purpose. Prescott's "Electricity and Electric Telegraph" is a good work for your use. We can mail it to you for $6.

(3371) J. C. T. says: In Avery's "Elements of Natural Philosophy," page 441, I read: 1. "When melted cast iron is poured into a mould, it expands in solidifying and presses into every part of the mould. The traces on the casting are, therefore, as clear cut as they were in the mould." Is that statement correct? A. The statement is not correct. Iron shrinks in solidifying. The sharp impression from the mould is made by the fluidity of the metal, and the pressure produced on the mould, surface by the weight of the iron and the static pressure produced by the height of the gate. Thus a gate that is 10 inches high from the bottom of the mould, and kept full while pouring, gives a pressure of 2½ pounds per square inch at the bottom. It is this and the fine finish of the pattern that brings out the sharp detail in the casting. 2. In using the solar microscope what can be done to prevent the concentrated sunlight from burning the object? A. For a solar microscope a water cell should be placed just before the condensing lens. Its thickness should be one-third the diameter of the condensing lens, made of two pieces of French plate glass set in a wooden frame with wax.

(3372) W. J. A. writes: 1. In making a resistance box for the eight-light dynamo how many ohms resistance is required to displace a 50 volt 16 candle power lamp? A. You will need about 50 ohms resistance. 2. What size wire (German silver) and how much is necessary? A. Use No. 26; you will require a little over ¼ pounds. 3. How can I make an automatic resistance controller? A. We shall have to refer you for this information to some of the works on electric lighting apparatus. The description of an automatic rheostat would occupy too much of our space.

(3373) E. A. C. writes: I have two handsome plaster images which have become badly broken. Can you tell me through your query column if I can repair them, and how it can be done? A. Wet the edges to be joined with water, coat them with a thick mucilage made of gum tragacanth, and place the edges together, allowing them to dry thoroughly. If any of the material of the image is lost, the deficiency may be supplied by applying a patch of plaster of Paris. The plaster should be mixed with water to form a thick batter and the edges to which the batter is applied should be wet.

(3374) H. R. asks for a sirup for making pop corn balls. A. Use simple sirup, which is made as follows: Take of white sugar 14 pounds (com.), water 1 gallon. Dissolve with the aid of a gentle heat, strain, and when cold add the whites of two eggs, previously rubbed with a portion of the sirup, and mix thoroughly by agitation. (The egg albumen is added to produce froth.)—From the "Scientific American Cyclopedia of Receipts, Notes and Queries." In press.

(3375) A. J. T. asks for pastes for razors. A. a. Paste for razors.—(Pradier.) Best putty powder 1½ ounce, jeweler's rouge 1¼ ounce, scales of iron ¾ ounces, levigated Turkey stone 4½ ounces, beef suet 2¼ ounces. b. Put equal parts of dried sulphate of iron and salt in a closed vessel, and apply a gradually increased heat; pulverize, elutriate, mix with lard or tallow.—"Scientific American Cyclopedia of Receipts, Notes and Queries." In press.

(3376) A. B. asks: 1. How can I test well water for injurious matter, animal or vegetable? A. Chemical and bacterial analysis is the best way of doing this, and even such analyses are not of absolutely certain interpretation. One simple method for a home test is to drop some sugar into the sample and leave it undisturbed. If it remains clear it is assumed to be of good quality, otherwise not. 2. What books can I get on that subject? A. We can supply you with Wanklyn's "Water Analysis," price $2; "Examination of Water for Sanitary and Technical Purposes," by Leffmann & Beam, $1.50 by mail post paid.

(3377) W. P. B. asks for a cochineal solution. A. Dissolve 1 gramme of cochineal in 75 cubic centimeters of 20 per cent alcohol. Alkalies will cause it to redden, and acids will bleach it.—From the "Scientific American Cyclopedia of Receipts, Notes and Queries." In press.

(3378) W. H. asks if there is any way of treating cotton or cloth to make them dry quickly, after being wet? A. We can only recommend treatment with paraffin, melting it into the pores with a hot iron. This will tend to shed water. It will for that reason prevent wetting, and so accelerate drying.

(3379) J. A. L. asks for the materials used for invisible writing which becomes distinct when heated. A. Numerous receipts are given for this. Simple lemon or onion juice answers very well. Dilute solution of cobaltic chloride or dilute sulphuric acid works well. The latter gives on heating an ineradicable mark.

(3380) T. McC. asks for a liquid gloss for harness. A. Glue 4 ounces, gum arabic 2 ounces, vinegar 1¼ pints, black ink ½ pint, isinglass 2 ounces. Soften the glue by standing in 1 pint of the vinegar, dissolve the isinglass in the ink, dissolve the isinglass in a little warm water. Add the rest of the vinegar to the glue solution, then warm it until solution is obtained, add the gum and ink and next the isinglass. When all is warm and thoroughly mixed, remove from fire.

(3381) C. W. N. writes: Please state whether, in your opinion, lightning rods on a building are a benefit or detriment, with reason why. A. Properly constructed lightning rods are undoubtedly a protection. Such a rod not only receives the discharge and conducts it to the ground, but it also tends to prevent a disruptive discharge by diffusing the earth's charge into the air.

(3382) F. W. writes: Can you tell me of some kind of metal that will melt at a very low degree of temperature, so that it can be placed in the circuit of a telegraph line to guard the instrument from any heavy discharge which may take place through the wire from lightning or from crossing electric light wires? A. Fusible metal is made of lead 31, tin 19, bismuth 50 parts. A wire of common soft solder will probably answer your purpose.

(3383) D. K. P. writes: It is not generally supposed, I believe, that oil and rubber will mix, but I understand it can be mixed. Will you inform me how it can be done. A. By heating together, virgin rubber and linseed and some other oils will mix more or less perfectly. Dippel's oil, obtained by distillation of bones, is one of the first solvents for rubber ever suggested. We recommend "Rubber Hand Stamps and the Manipulation of India Rubber," $1 by mail.

(3384) W. G. S. asks: 1. How can I get copper oxide in a finely divided state, attached or made into a plate, for making a copper zinc storage battery, using alkaline solution electrolyte? A. You can procure black oxide of copper from any dealer in chemicals in this city. 2. How can this plate be thoroughly oxidized? A. The copper is oxidized before it is placed in the battery. 3. Would asbestos cloth do for the bag in which to place the copper plate? A. We think asbestos cloth will answer. 4 What fabric would be likely to stand the solution that would not be too porous? A. See answer above. 5. Can you give me a rule for winding a small motor, to get the best results, from two volts, and to take about one ampere when working? A. Wind you motor so as to give it a total resistance of 2 ohms. If it is a shunt machine, the field magnet should have about fourteen times the resistance of the armature. 6. With a given amount of pressure current and wire, would there be any gain in making an armature with teeth projecting between the windings? About what per cent, if any, could be gained by getting the armature close to the fields? A. This construction would give improved results. We cannot give the percentage of gain. 7. If weight is not a consideration in a small motor, what could be gained by using permanent magnets for the fields? If nothing could be gained, why, since it seems that there would be a gain with limited pressure, giving the armature all the current? A. The advantages of regulation would be lost by using permanent magnets. There is practically no economy in using permanent magnets.

(3385) G. P. writes: 1. In referring to George M. Hopkins motor in SCIENTIFIC AMERICAN SUPPLEMENT, No. 641, page 10240, April 14, 1888, what size of wire can I use on the field magnet, when the armature is of No. 22, and what kind of a battery must I use? A. This will depend upon the length of wire upon the armature, and upon when whether the motor is used as a shunt or as a series machine. Probably No. 26 would be about right for a shunt machine. Use 8 cells of large Bunsen battery or of plunging battery in series. 2. Can I make a bar commutator for the above motor, and what is the easiest way to make one? A. For the construction of a bar commutator consult SUPPLEMENT, No. 641. 3. Referring to Edison's dynamo and motor, of July 25, 1891, what is the use of the vulcanized fiber collars at each end of the field magnet winding? A. The fiber collars are for receiving the canvas cover.

(3386) W. McL. asks: 1. Why is a steamship funnel given aft rake? Has it any effect on the draught? A. The rake of the funnel is for symmetry with the masts, and also helps the draught. 2. What is the difference between plain wool and dyed wool? Does woolen underwear that is dyed red possess medicinal properties? A. We do not know of any special medicinal value in red flannel. 3. Will a piece of iron lodged in the corner of the eye work inward or remain stationary? A. Iron chips in the surface of the eyeball or skin are likely to remain there unless removed, becoming encysted. 4. If two safety valves are fitted on two separate pipes, one twice as large as the other, both valves same size and weight, and same pressure of steam in both pipes, which valve will blow off first, and give cause? A. The valves should all blow off at the same pressure, without regard to size of pipe.

(3387) J. B. B. says: Suppose a jet of steam be discharged from a tube, one inch in diameter, what force would the steam exert, coming in contact with a body to be moved? How large and of what strength would such a tube have to be constructed, to exert a force equal to one horse power? A. Steam issuing from an orifice at 100 pounds pressure has a velocity of 898 feet per second, and at 50 pounds pressure a velocity of 878 feet per second. As a 1 inch orifice is 0·78 inch area, the pressure would be less than 0·78 of the boiler pressure against a body in contact with the end of the pipe, but would rapidly decrease as the body moved away. Any ordinary iron pipe is strong enough, but should be larger than 1 inch from the nozzle to the boiler to prevent friction. At 50 pounds boiler pressure the total power of the jet would be possibly 25 horse power, from which 15 horse power may be realized. With the same pressure a jet nozzle of ¼ inch diameter would realize 1 horse power.

(3388) W. S. writes: I have a polishing head which I wish to use for sharpening and polishing surgical instruments, etc. I want to use emery, crocus, tripoli, and Vienna lime. With what should each be mixed to use on leather and felt covered wheels? How is Vienna lime used for polishing steel? A. Use the materials named with water for preliminary polishing, brighten with crocus and Vienna lime mixed with alcohol on cotton buff. The "Practical Gold Worker," and the "Silversmith's Manual," are the best books, $1.25 each mailed.

(3389) J. H. asks: What causes the hollow sound under foot while walking over the ground? There are several places in the immediate vicinity that are apparently as hollow as a drum for a space of ten feet square. A. A hollow sound is produced when the soil is made up of light material, such as dry leaves, especially the leaves of evergreen trees, or chips, shavings or sawdust. In some cases a horizontal seam in the rock near the surface will give the rock or the earth upon the rock a resonant character.

(3390) B. H. asks: 1. How can I make a condenser for a three horse power engine, the engine being in the cellar? I want to get rid of the steam, so as not to annoy my neighbors. I would like a very simple way to do it. A. For your condenser use a coil of iron pipe, say of 1 inch diameter and about 100 feet in length, arranged so that the air will circulate around it, and the water drip freely away. 2. I have a small lathe with one treadle, the balance wheel is 3 feet diameter, rim 3 inches wide by ¾ thick. I have attached the lathe to a grinding machine by belt; one man and a boy can run the machine at full speed for two minutes. Now what size steam engine will run this machine? A. You will need a nominally ¼ horse power engine, or a 2¼×3 inches cylinder. 3. Will one man and a boy develop ¼ horse power in the manner above? A. Yes. 4. I am making emery wheels by coating a wooden wheel with glue, then emery, and keep on until about ⅛ inch thick; is this emery wheel more or less liable to burst than a solid emery wheel? A. If your wooden frame is made of proper strength, it should be strong enough for the purpose, but not to be trusted at as high velocity as the best solid emery wheel, unless for small wheels of solid wood. 5. These emery wheels, when made of fine emery, glaze, and will not cut or polish glass; how can I make them so they will not glaze? A. Glass is not cut on solid emery wheels, unless they are made to run in water. For this purpose waterproof wheels are used. Glass should be cut with a lead wheel, fed with emery and water. Wheels that do not glaze must be made with a cementing material that will allow the emery to crumble from the wheel easily. Very light pressure should be used on emery wheels for all work. 6. How can I make a first class glue for belts? A. You will need nothing better than the best glue on sale, which should be of a light brown color and very tough when the pieces are bent in the hand. Put a few drops of glycerine in a pot of glue for gluing belts.

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